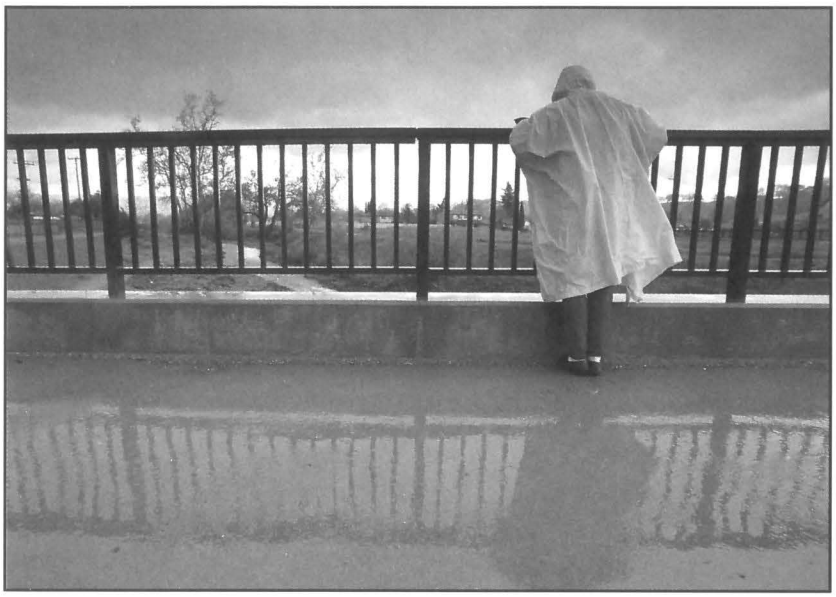


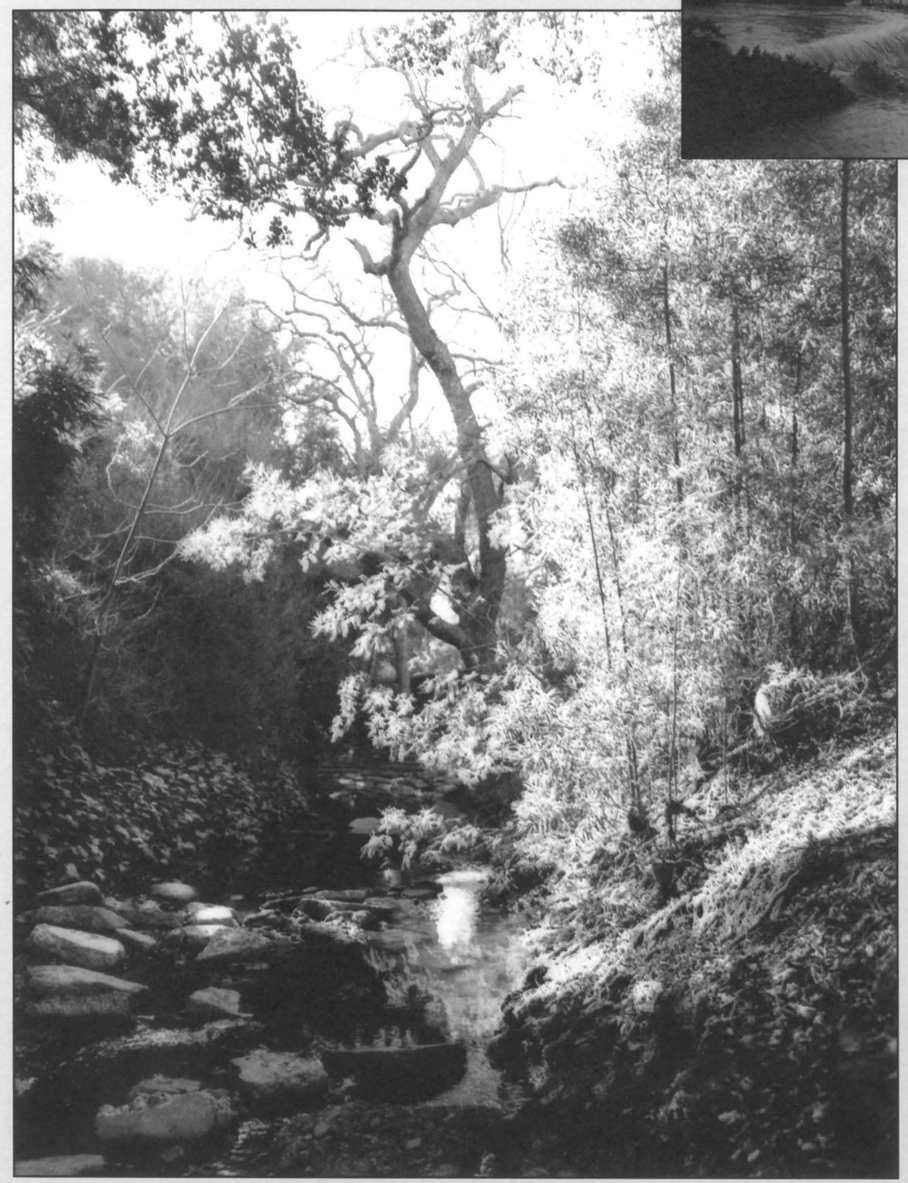
FLOOD CONTROL
IN THE
SANTA CLARA VALLEY

AN OVERVIEW

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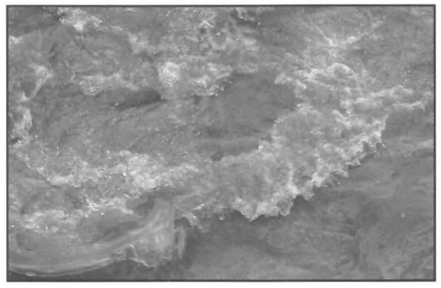


Flooding in 1955



Santa Clara County creeks, such as Barron Creek, are normally serene (above).
At other times they swell with storm waters and, in some locations, flooding is the result (right).

INTRODUCTION





Flooding in 1983

A fast flowing river, a meandering creek, a dry riverbed — under certain conditions any of these waterways may swell with runoff from rainfall and flood surrounding property. The waterways in Santa Clara County are no exception.

A major flood in Santa Clara County could threaten human lives and damage tens of thousands of homes and businesses. The Santa Clara Valley Water District, as the countywide flood control agency, works to reduce or eliminate this threat of danger and flood damage.

In the 1980s, voters in four of the district's five flood control zones approved an increase in flood control benefit assessment limits and extended the benefit assessment programs through June 2000; the fifth zone approved the extension in 1990. These benefit assessments enable the district to provide additional maintenance on most creeks in the county, and to build many flood control projects sooner — up to 20 years sooner — than anticipated. As these projects are completed, the threat of flooding will be reduced and mandatory flood insurance will be removed for thousands of homes and businesses.

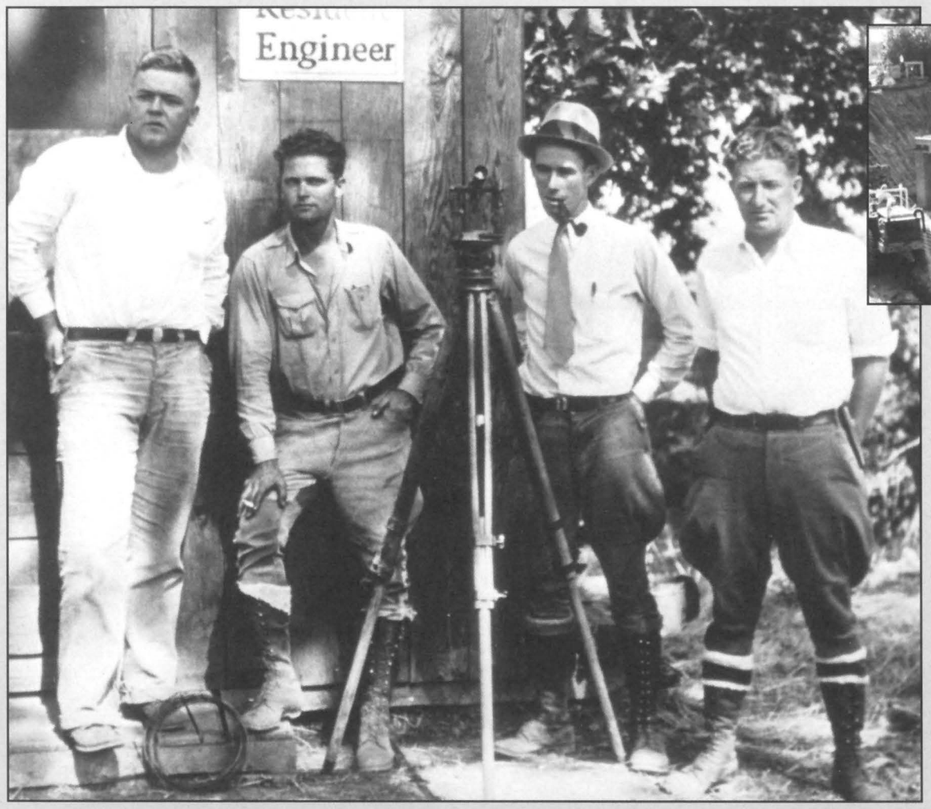
Since 1981, the district's construction program has completed more than $100 million in flood protection projects, more than any local flood control agency in the state.

Traditionally, the district has received many public inquiries about its flood control activities; accelerated construction has generated increased public awareness and interest. This brochure introduces and explains the district's flood control program. It describes why and where floods happen, explains the planning, funding and implementation of various flood control projects or solutions, outlines the district's permit process, and contains useful suggestions for protecting one's family and property prior to and during a flood.

Definitions of flood control terms can be found in the glossary.



Santa Clara Valley Water District headquarters

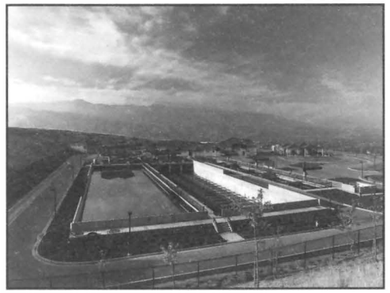




Stevens Creek box culvert construction under Central Expressway and the Southern Pacific Railroad tracks.

Engineers employed during the depression of the 1930s worked to oversee the construction of six dams — Stevens Creek, Vasona, Guadalupe, Almaden, Calero and Coyote — all built between 1934 and 1936. Anderson, Chesbro, Lexington and Uvas dams were built in the 1950s.

THE DISTRICT — YESTERDAY AND TODAY



Santa Teresa Water Treatment Plant



The Santa Clara Valley Water District Board of Directors meet once each week in sessions open to the public.

THE DISTRICT'S ORIGINS

The Santa Clara Valley Water District traces its origins to two special districts: the Santa Clara Valley Water Conservation District, formed in 1929, and the Santa Clara County Flood Control and Water Conservation District, formed in 1951. In 1968, these two agencies merged, creating a countywide agency responsible for managing an integrated program of water supply and flood control activities.

Over the years, the district's responsibilities have expanded beyond water supply and flood control into every aspect of water management: spearheading water conservation efforts, taking the lead in protecting water quality in Santa Clara County, planning to avoid or minimize environmental impacts, and striving to maximize public benefit from district facilities.

Today, the district manages three drinking water treatment plants; three pumping stations; a hydroelectric plant; hundreds of miles of rivers, creeks, and other waterways; 19 percolation facilities; and an extensive in-county water distribution system of major pipelines that connect sources of imported water, local reservoirs, and water treatment facilities.

MANAGING THE DISTRICT

A seven-member board of directors governs the district. The board sets district policy, approves expenditures, and serves as the primary vehicle for communicating public input to the district staff. Five directors are elected, one from each of the five county supervisory districts, and two directors are appointed by the Santa Clara County Board of Supervisors to represent the county at large. The directors serve over-lapping four-year terms. Five flood control advisory committees, one for each flood control zone, assist the board in developing policies to guide district flood control operations.

Two full-time staff positions are directly responsible to the board: the general manager and the general counsel. The general manager directs and coordinates all district activities under policy direction of the board of directors, and serves as administrative head of the district in its relations with the board, the public, legislative bodies, and local, state and federal public agencies. The general counsel advises the board, the general manager, and district staff on all legal matters.





FLOODING IN THE SANTA CLARA VALLEY



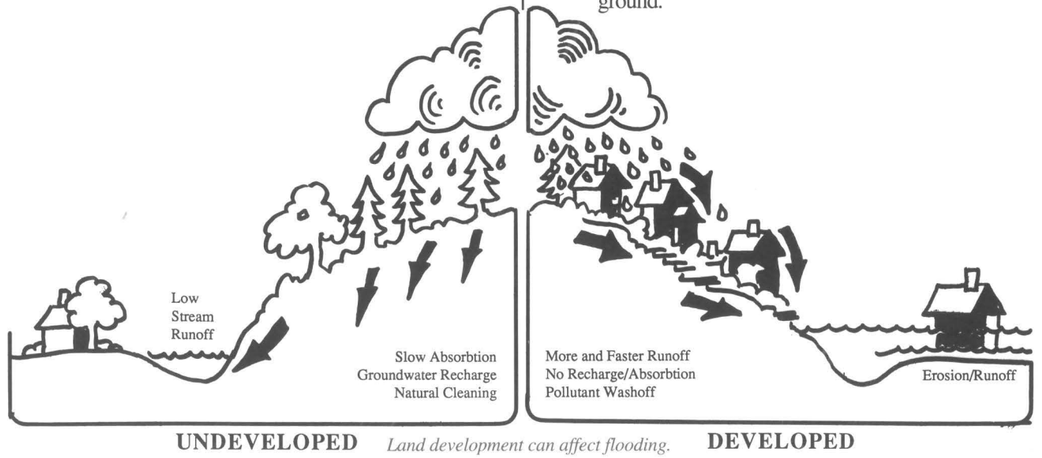


HOW FLOODS FORMED THE VALLEY FLOOR

For millions of years, rainfall runoff eroded the hills that border Santa Clara Valley, creating the valley floor. Runoff continued to cut channels or creeks through the valley. While these channels are large enough to carry water from minor storms, many are too small to carry all the water from larger storms. Thus, through the ages, floodwaters caused the valley's creeks to overflow their banks, inundating surrounding land, depositing silt over vast areas, and adding to the rich, fertile soils of the valley floor.

HISTORY OF FLOODING IN THE VALLEY

Flooding has challenged the valley's inhabitants since the establishment of permanent settlements. To the valley's early residents, the Ohlone Indians, flooding meant the temporary inconvenience of relocating their villages, most of which were built along streams. The Spaniards who colonized the valley followed suit, building the first mission and pueblo near the Guadalupe River in the late 1700s. Their earthen dams and irrigation ditches failed to protect against the river's frequent floods, and before the century's end, both the pueblo and the mission were moved to higher ground.



UNDEVELOPED *Land development can affect flooding.* **DEVELOPED**





Gilroy, CA 1986

As agriculture and towns spread across the valley, winter and spring floodwaters provided much-needed irrigation for fields and orchards. In fact, until the early 1900s, the need for water to irrigate crops seemed to outweigh the fear of damage by floodwaters.

". . . the tremendous drenching did little harm and a vast amount of good — orchardists, stock and businessmen are all gleeful despite damaged roads and bridges."

Jan. 20, 1906, San Jose Mercury

However, as the valley's land uses changed from agricultural to residential/industrial, and development moved into the foothills, flood damage became a larger concern. Development brought more buildings, more streets, and more sidewalks — all impermeable surfaces that prevent rainfall from seeping into the soil and, instead, convey it quickly into creeks.

As flooding problems intensified on the valley floor, levees were constructed to contain flood flows along some creeks. But flood control was a fragmented operation in the early half of this century. By the mid-1950s, stream channel improvements to control flooding were established for only a handful of creeks. Each city handled its own local drainage differently, and subdivisions were often constructed with only the streets to act as storm drains. The concentration of development on the valley floor and the lack of flood control facilities resulted in flood damage ranging from minor to devastating.



"For a time San Jose found itself a virtual island in the midst of flotsam and jetsam from the surrounding hills as all major roads in all directions were either cut off or severely restricted to creeping traffic."

Dec. 24, 1955, San Jose Mercury

THE PUBLIC'S RESPONSE

Despite the risks, development continued to occur in and near areas known to flood. Today, the vast majority of homes, industry, and commercial buildings in the county



Flooding 1986





stand where flood waters have flowed for eons. The Santa Clara Valley has experienced major floods often enough that residents understand the high potential for flood damage. A high level of public awareness has generated ongoing support for the district's flood control program.

In June 1982 voters approved flood control benefit assessments providing funds for expansion of the flood control program. This was the start of a new era of renewed efforts to reduce flood damage in Santa Clara County. The floods in 1982, 1983 and 1986 provided additional impetus to accelerate planning and construction of new flood control projects.

"Police sirens and bullhorns roused hundreds of Gilroy residents early today as city officials called for the second straight day of evacuations to protect residents from the raging Uvas Creek."

Feb. 19, 1986, The Dispatch, Gilroy

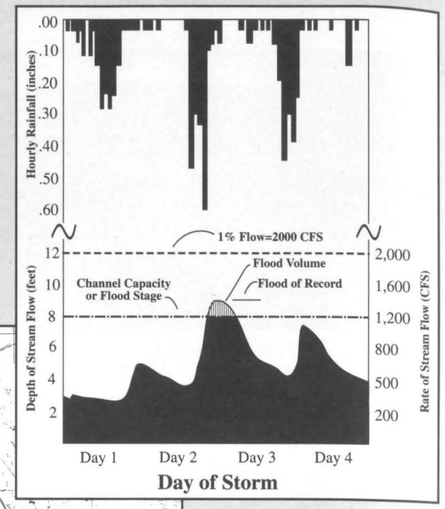
Although the district can significantly minimize the risk of flood damage, this risk can never be completely eliminated. Nature can cause flooding greater than the carrying capacity of man-made flood control facilities.

STORM DRAINS VS. FLOOD CONTROL CHANNELS

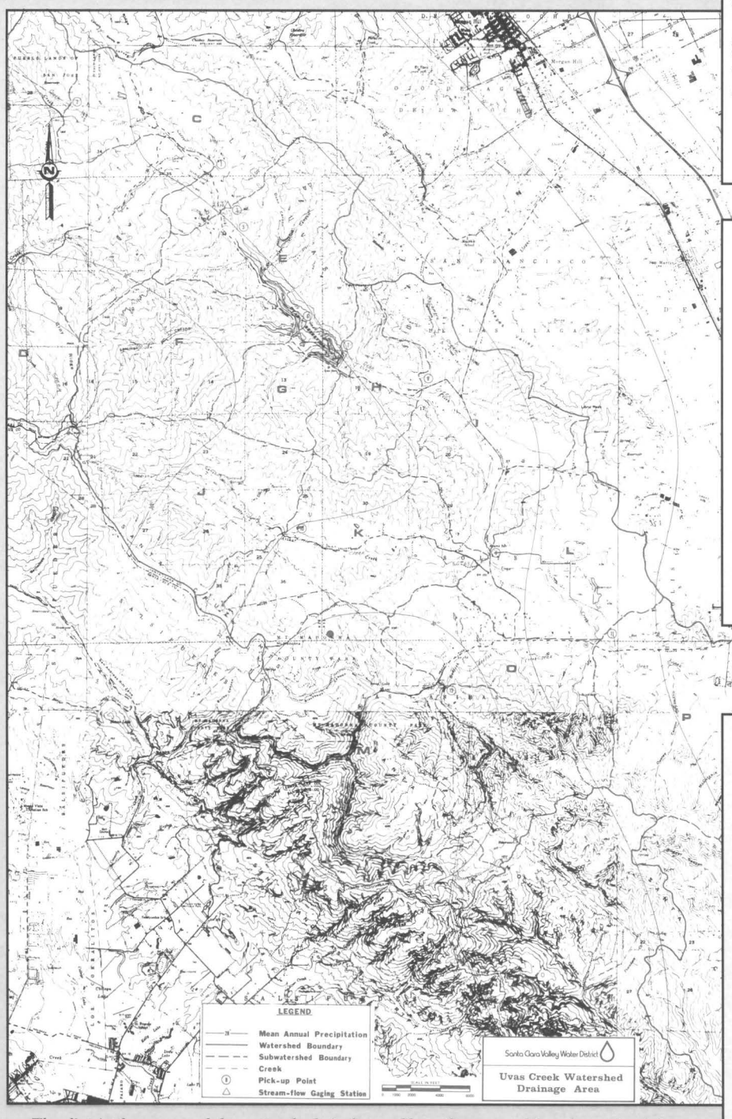
In Santa Clara County, responsibility for addressing flooding is divided jurisdictionally into "local drainage" problems and "flood control" problems. Local drainage problems, by definition, are those where the tributary drainage area is less than one square mile. They are typically handled by the county and city governments through their construction of curbs, gutters, inlets and storm drains that collect runoff and direct it into the major creeks and channels on the valley floor. When there is too much rainfall runoff for the local systems, waters overflow into city streets and usually cause minor flooding that may impede automobile travel but usually does not cause much economic damage to properties, nor loss of life.

The major creeks and channels that collect runoff from storm drains are under the jurisdiction of the Santa Clara Valley Water District and make up the "flood control" system. When there is too much runoff for the flood control system to handle, major life and property-threatening flooding can be the consequence. To reduce the potential for loss of life and damage to private and public property, the district expends much of its funds enlarging undersized creeks through its flood control program.

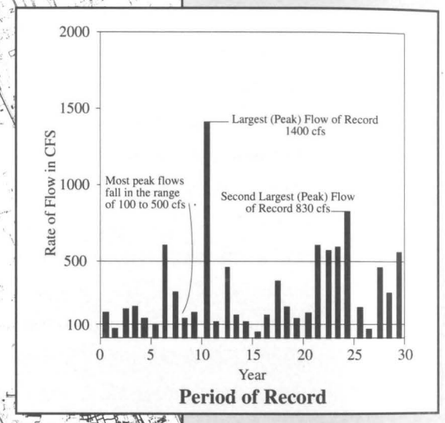
Typically, storm drains are funded from the general funds of the county and cities, whereas flood control projects on major tributaries are paid for from property tax and benefit assessment revenues collected by the district for this purpose.



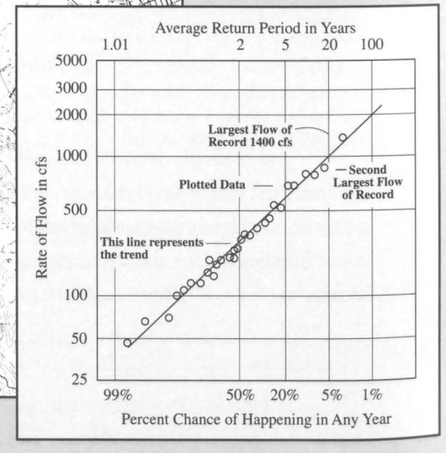
A hydrograph records the amount of water flowing in a creek as measured by a stream gauge. The above figure shows the hydrograph and the corresponding rainfall recorded for a sample creek.



The district has mapped the watersheds in Santa Clara County and has determined the magnitude of the 1-percent flood for each.



Recorded maximum annual stream flows for a sample creek



Hydrologists plot recorded flood flows on frequency charts that help determine the 1-percent flood flow of a creek.

WHY FLOODS HAPPEN

Flooding in inland areas is usually caused by rainfall, although large rain storms may not always result in floods. The occurrence of an inland flood depends on both the amount of rainfall and the condition of the drainage basin or watershed before and during the storm.

When rain falls on a watershed that is saturated, or when a very large amount of rain falls on a dry watershed faster than it can be absorbed, it "runs off." When this runoff exceeds the carrying capacity of the receiving watercourse, flooding results.

Tides also affect the flooding potential of creeks in low-lying areas near San Francisco Bay. High tides make it more difficult, or impossible, for creek flows to discharge into the bay and very high tides can directly flood low-lying bayland areas.

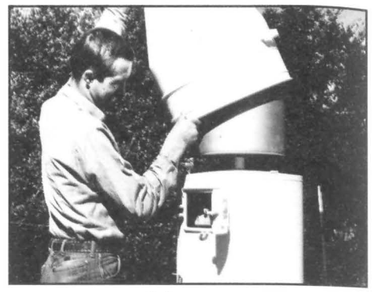
Ground surface conditions, too, affect flooding. Surface soil composed of sand or gravel absorbs rainfall rapidly. But if clay is present, very little water is absorbed and most runs off into streams. Where the land is covered by buildings, streets, sidewalks, driveways, and parking lots, rainfall cannot seep into the ground; thus more storm water flows into the creeks more rapidly than where land is undeveloped.

THE 1-PERCENT FLOOD

While there is no economically reasonable way to protect against any catastrophic flood that might occur, flood control engineers and economists have agreed that it is reasonable to provide flood protection for the 1-percent flood.

The 1-percent flood is the flow of water that has a 1-percent chance of being equalled or exceeded in any given year. It is also referred to as the 100-year flood, since over a period of several thousand years, it is the flood that would occur on the average of once in 100 years. This terminology can be misleading. If a major flood occurs one year, it does not diminish the chance of an equally large or larger flood occurring the very next year.

In 1990, nearly 300 miles of Santa Clara County's 700 miles of waterways were inadequate to carry waters from a 1-percent flood. If a flood of this magnitude occurred throughout the county, the resulting damage would approach $1 billion. Some 65,000 residences, 5,000 businesses, and more than 20,000 acres of agricultural land would be flooded to varying degrees. The district, like other flood control agencies throughout the United States, builds and maintains its flood control projects to reduce the potential for damage from the 1-percent flood.



Rain gauge



Stream gauge

ESTIMATING FLOOD FLOWS

To design a flood control channel to carry 1-percent flood flows, engineers need to know the peak flow: the maximum rate of runoff that could be expected from the 1-percent flooding event. The science of hydrology helps the district estimate the peak flow and the flood volume for the creeks in Santa Clara County.

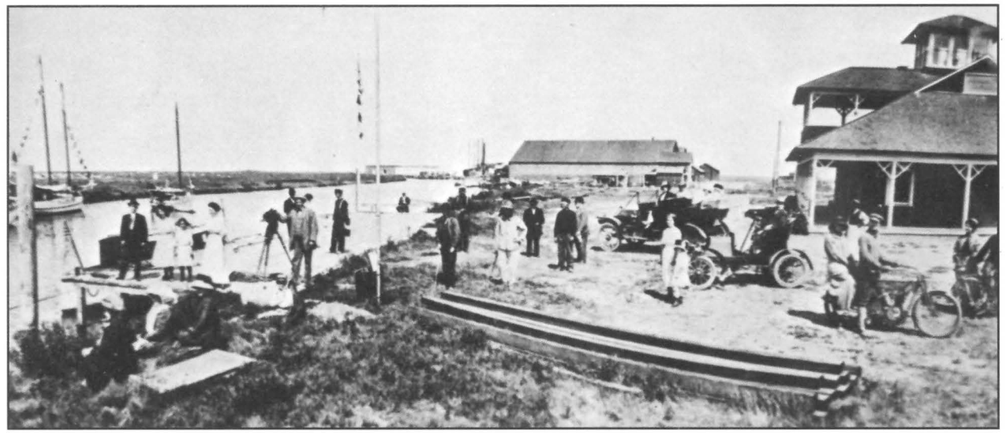
The district's hydrologic method has evolved over the course of many years into a procedure endorsed by internationally respected hydrologists. This method relies primarily upon historical streamflow and rainfall data both from the local area and from surrounding counties.

The district collects data from more than 100 streamflow, reservoir and rainfall gauges. The district was among the first in the state to install a radio data gathering network that continuously reports changes in streamflow, reservoir levels, and rainfall records. Sophisticated computer programs help organize and analyze basic data collected from these and other gauges. The district also monitors subsidence and sedimentation, and their effects on creek capacity.

The district uses both historical records and statistical methods to estimate future stream flows. Records of rainfall, stream flow, and reservoir levels are analyzed to determine how much rain has fallen, how large flows have been, and how often they have occurred. Patterns of flow magnitude and frequency suggest trends. These trends and records are used to determine the magnitude of the 1-percent flood flow, even though a flow of this size may not have occurred during the period of record.

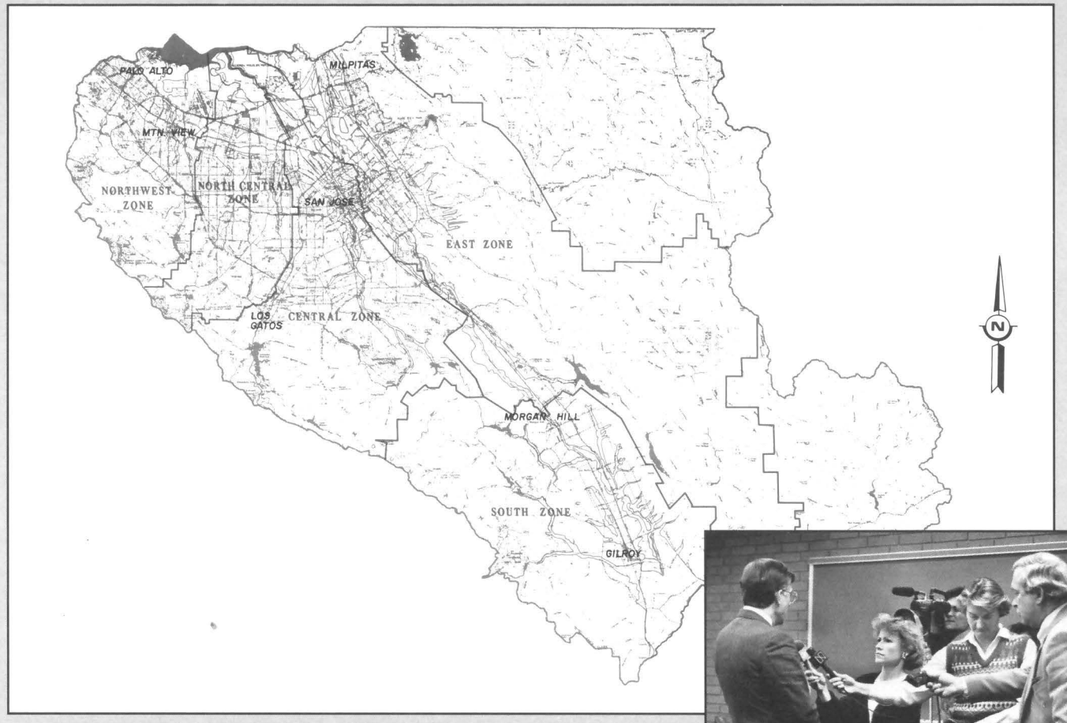
Because not all streams have gauges and good historical data are not available on every stream, another technique for estimating 1-percent flood flows has been developed. This method uses statistics, streamflow data on similar streams, rainfall data, and measurable watershed characteristics to estimate the size of the 1-percent flow. These estimates are checked and verified by using streamflow data on streams in the area that have been recorded for a long period of time.

Once the magnitude of the 1-percent flow is projected, estimates of possible damages can be made and protective measures proposed. Like everything else in nature, the 1-percent flow changes as the condition of the watersheds change and as the basic data change. As a matter of policy, the district reviews the 1-percent flows every ten to fifteen years.



Dramatic evidence of land surface subsidence is illustrated by these photographs of the Alviso Yacht Club, first in 1914 and then in 1978. Fifty years of heavy pumping caused the ground surface to sink more that 10 feet in Alviso. Levees were built to protect the bayland areas from both salt- and fresh-water flooding.

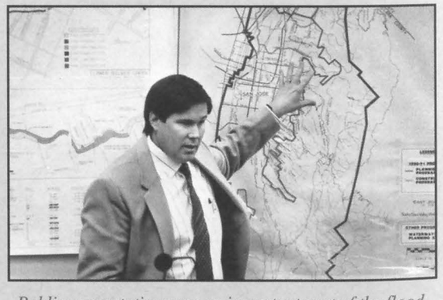




There are five flood control zones in Santa Clara County.



Water issues, whether floods or drought, get plenty of media attention in Santa Clara County.



Public presentations are an important part of the flood control planning process.

FLOOD CONTROL PLANNING

FLOOD CONTROL ZONES

The district's boundaries coincide with the boundaries of Santa Clara County. With the exception of a 300 square-mile area in the northeast portion of the county, the district is divided into five flood control zones for purposes of operating the flood control program. The four northernmost flood control zones drain into San Francisco Bay, and the south zone drains via the Pajaro River into Monterey Bay. Each of these zones has a separate flood control program and each is a separate fiscal entity with its own revenues and expenditures (see map on page 14).

An advisory committee from each zone keeps the board informed on flood control issues of local concern. (The northeast portion of the county, which drains into San Francisco Bay via Alameda County, is not in a flood control zone. Because there are no known flooding problems in this area, no flood control zone or benefit assessment program was established there.)

CUSTOM-MADE SOLUTIONS

For each flood problem, the district develops a solution that provides needed flood protection with minimal environmental impacts and that satisfies the requirements of the local community. Flood control solutions must also satisfy regulatory agencies, such as the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the Regional Water Quality Control Board, the federal Emergency Management Agency and the state Department of Fish and Game.

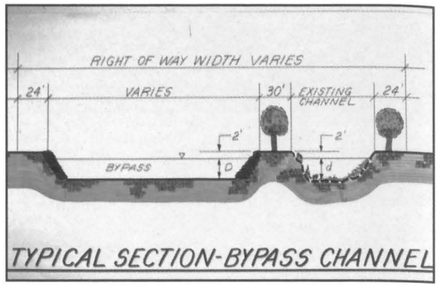
In some cases, the district works with the county and the cities to prevent or regulate development in flood areas by advising local jurisdictions on land-use planning. In other cases, the district corrects existing flood problems by modifying the size or shape of a channel, or by building levees or concrete flood walls to confine flood flows to areas that will not cause damage.

From initial planning to final construction and maintenance, a flood control project goes through several phases.

Designing a solution to a flood problem requires the cooperation of engineers, maintenance workers, planners, environmentalists, managers, office support people, other public and private institutions, advisory committees, and members of the public.



District engineers study different ways to safely contain flood waters.



Drawings of feasible flood control alternatives are used for public presentations.

PLANNING AND SETTING PRIORITIES

How does the district decide when and where to provide flood protection? The first step involves setting priorities. Using a computer program developed by the district known as the Waterways Management Model, the district compiles and organizes important data such as areas of flooding, estimated flood flows, depths of flooding, and potential flood damage for each stream. This information provides a basis for deciding which projects receive the highest priority in each zone.

To determine project priority, each project is evaluated based on eight criteria. Mathematical weight is assigned for each criterion, with the greatest weight given to those projects that will prevent the greatest potential flood damage, and those projects that protect against flooding of more-developed areas (see box for complete list).

Projects are scheduled in the order of their priority rankings, except in two cases.

FLOOD CONTROL PROJECT PRIORITY CRITERIA

1) Projects that will prevent the greatest potential flood damage. 50%

2) Projects that protect against flooding of developed areas before undeveloped areas. 12.6%

3) Construction of reaches of inadequate channel between previously improved reaches of the same channel. 9.2%

4) Projects that provide for rehabilitation of previously constructed facilities over new construction. 6.3%

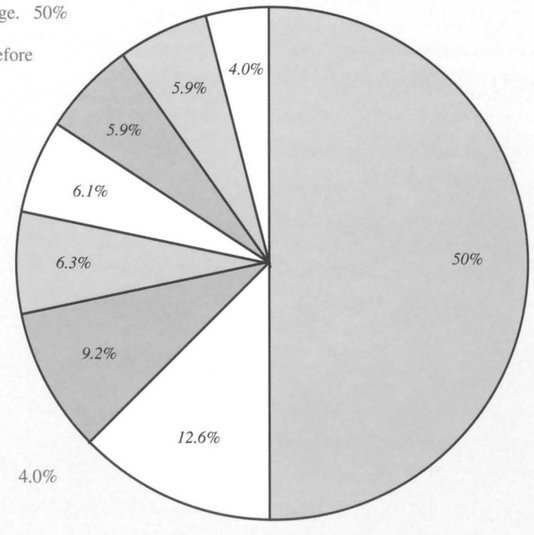
5) Projects that will protect from flooding areas of proposed development over areas where development is not proposed. 6.1%

6) Projects that provide adequate flood carrying capacity in downstream reaches first. 5.9%

7) Projects that improve capacity and stability of channels when such improvement will substantially reduce maintenance costs. 5.9%

8) Projects that include multipurpose use of district facilities. 4.0%

Sum: 100%







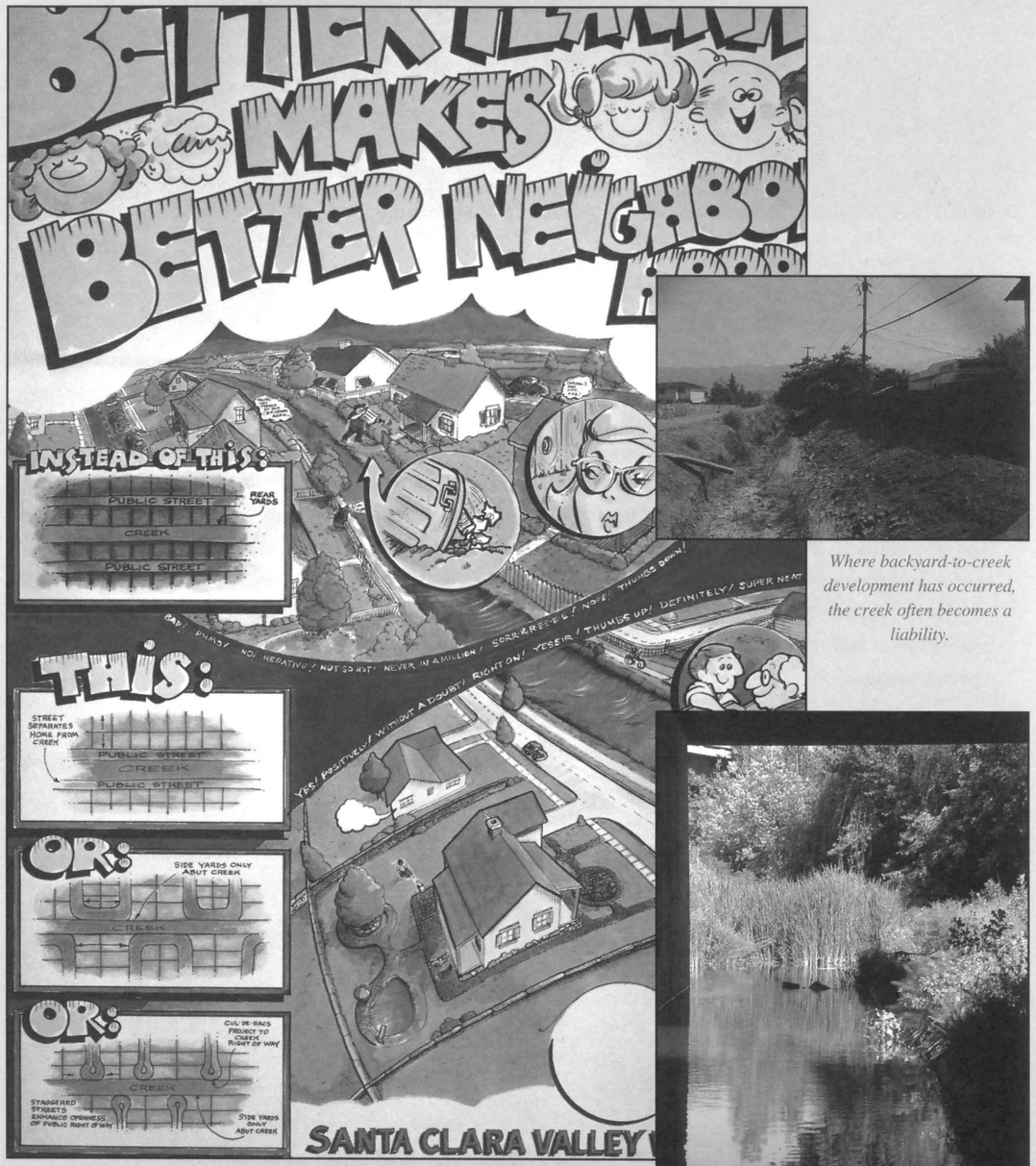
1. If the project requires a cooperative effort and/or funding with a city, the county, or the federal government, project schedules usually are shifted to accommodate the cooperating agency's schedule.

2. A project will not be constructed if, by building it, the district would cause greater flooding elsewhere. For example, rather than induce downstream flooding, the district would schedule downstream flood control improvements first, then proceed with the upstream projects.

PUBLIC INVOLVEMENT

Deciding the priority of flood control projects is a crucial step in the planning process, and is one in which public representatives play an important role. All priorities are set in conjunction with the advice of the flood control zone advisory committees. These committees are composed of representatives from each city in the zone, a representative from the county where the unincorporated area exceeds 25 percent of the area of the zone, and public at-large appointments made by the district's board of directors. Committee members review and make recommendations to the board on flood control policies, flood control projects and schedules, flood control zone budgets, and the means of financing flood control activities. The committees meet at least four times each year. These committees are the major link between the district and the local communities. Committee members represent the needs and desires of the citizens of their communities to the district, and convey information of district activities to their communities.





The district recommends that streets or open space separate houses from creeks.

Where backyard-to-creek development has occurred, the creek often becomes a liability.

Where streets separate houses from the creek, the creek becomes an amenity to the neighborsand the community.



LAND-USE PLANNING

In any flood control program, an ounce of prevention is worth a pound of cure. It usually is easier and less costly to prevent a flooding problem than to correct one. Preventive methods are preferred and generally are used where development has not yet occurred in a floodplain, but where the potential for such development exists.

The district's land development review process is an important preventive element of its flood control program. Because the authority in land-use planning rests with city and county governments, the district has only an advisory role in this area. By ordinance, however, the district has the right to review land development proposals and to issue permits for all development and activities in or near creeks.

During the review process, the district advises the cities, the county, and the land developers as to the severity of any flood and erosion hazard that may affect the site. The district also proposes means of flood protection that the developer can implement and requests dedication of right-of-way for future district projects. The district opposes development in floodplains unless the development meets Federal Emergency Management Agency standards. This assures that new development will not be subject to flooding from the 1-percent flood.

APPROPRIATE STREET DESIGNS

When development is proposed adjacent to a creek or waterway, the district recommends alternative street designs that can prevent or minimize potential problems. In the past, homes in creekside subdivisions were built such that lots abutted the creeks. As a result, many creeks have become isolated from community view and access and now attract litter, vandals and off-road vehicles.

Rather than a traditional, backyard-to-creek layout, the district recommends that developers build streets and open space that separate residential lots from waterways. Some possible designs include streets that run parallel to the creek, loop next to the creek or end in cul-de-sacs adjacent to the creek.



Good planning results in useful, attractive streamside development.



School children learn about flood control on district provided tours.



Communities often take an active role in keeping neighborhood waterways clean.



Integrating the creek into the surrounding neighborhood increases homeowner security, allows pedestrians and passing motorists to enjoy the open space, and enhances access for policing and flood control maintenance. Successful alternative street designs have been built along several creeks in the county, including Alamitos Creek in Almaden Valley, and Los Gatos Creek in San Jose.

PREVENTING INDUCED FLOODING

During the development review process, the district strives to ensure that proposed developments do not cause or increase flooding on any other property. For example, the pavement, gutters, streets, and storm drain system proposed for a residential subdivision might increase the speed at which rainwater flows into a creek, causing the creek to flood its banks further downstream. In this case, the district may recommend that the developer build on- or off-site retention ponds to collect the runoff from the development during a storm and release it gradually to the flood channel once the flood flows from the storm have peaked.

DEDICATION OF RIGHT-OF-WAY

Where a change in land use adds to the need for a flood control project, the district asks property owners to contribute to the public cost of such a project. Generally, owners of developing properties dedicate to the district the land that is necessary to construct a channel that can convey the 1-percent flood flow, or grant the district rights to use the land.

When new streamside development is proposed, the district will request that appropriate setbacks from any planned flood control project be provided. It may also request dedication to the district of an easement over the creek and a portion of the bank area to accommodate future flood control improvements and maintenance. Fee title or permanent easements must be acquired by the district before it can build, repair, or maintain a flood control facility.

DISTRICT PERMIT PROCEDURE

In order to protect waterways and other district facilities against acts that might interfere with their function or integrity, the district requires that permits be obtained. The district issues two types of permits related to waterways: construction permits and encroachment permits.

Construction permit

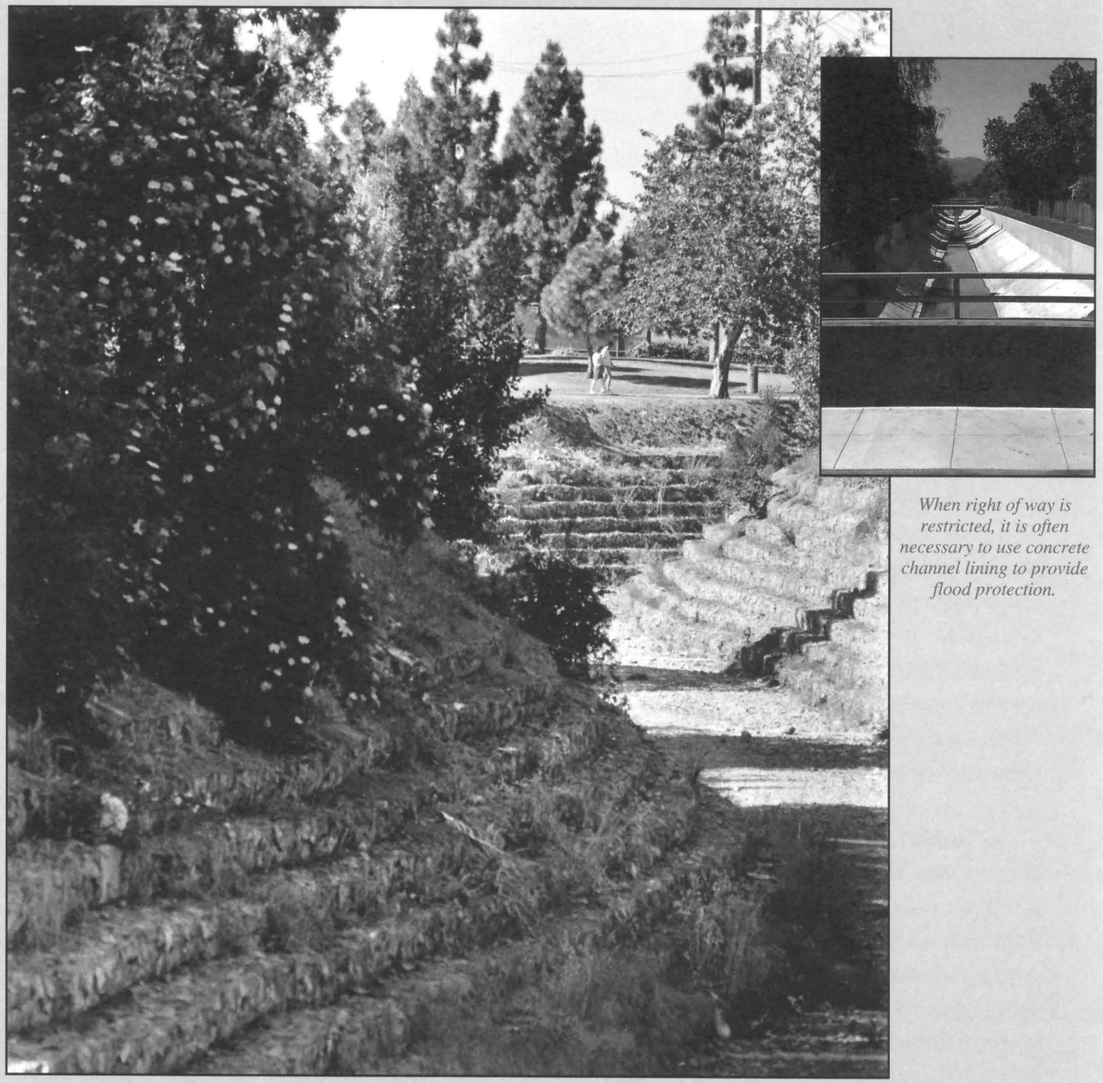
Individuals, utilities and public agencies must obtain a permit from the district for construction on any property that the district owns or has an easement on; or for construction within 50 feet of the top of a creek bank, regardless of ownership. Permits are not needed for construction in or near creeks that have a drainage area less than 320 acres. Those seeking a construction permit should send construction drawings along with a letter requesting a permit to the district's design coordination division.

Encroachment permit

Some uses of district lands by others are allowed through a district encroachment permit. Examples include a community sponsored creek clean-up day or temporary use of a district access road to construct a swimming pool in a residential backyard. Those seeking an encroachment permit should send a letter describing the use and requesting a permit to the district's design coordination division.

PUBLIC EDUCATION

The district's school outreach program brings water management into the classroom. The program includes distribution of educational materials and films, facility tours, teachers' workshops and classroom presentations.



When right of way is restricted, it is often necessary to use concrete channel lining to provide flood protection.

Rock-filled wire baskets (gabions) protect the banks of the enlarged Saratoga Creek from erosion.

CORRECTIVE FLOOD CONTROL MEASURES



Gabions



Levees are an often used method of flood control.

PLANNING AND DEVELOPMENT: A TEAM APPROACH

Corrective flood control measures often are more complicated than preventive measures, and are developed in several phases. Such corrective measures include concrete, rock, gabion, or earth channels; levees; floodwalls; modified floodplains; and bypass channels (see following pages for photos). Depending on a project's size, complexity, and the level of public concern, project planning and construction may take several months or years to complete.

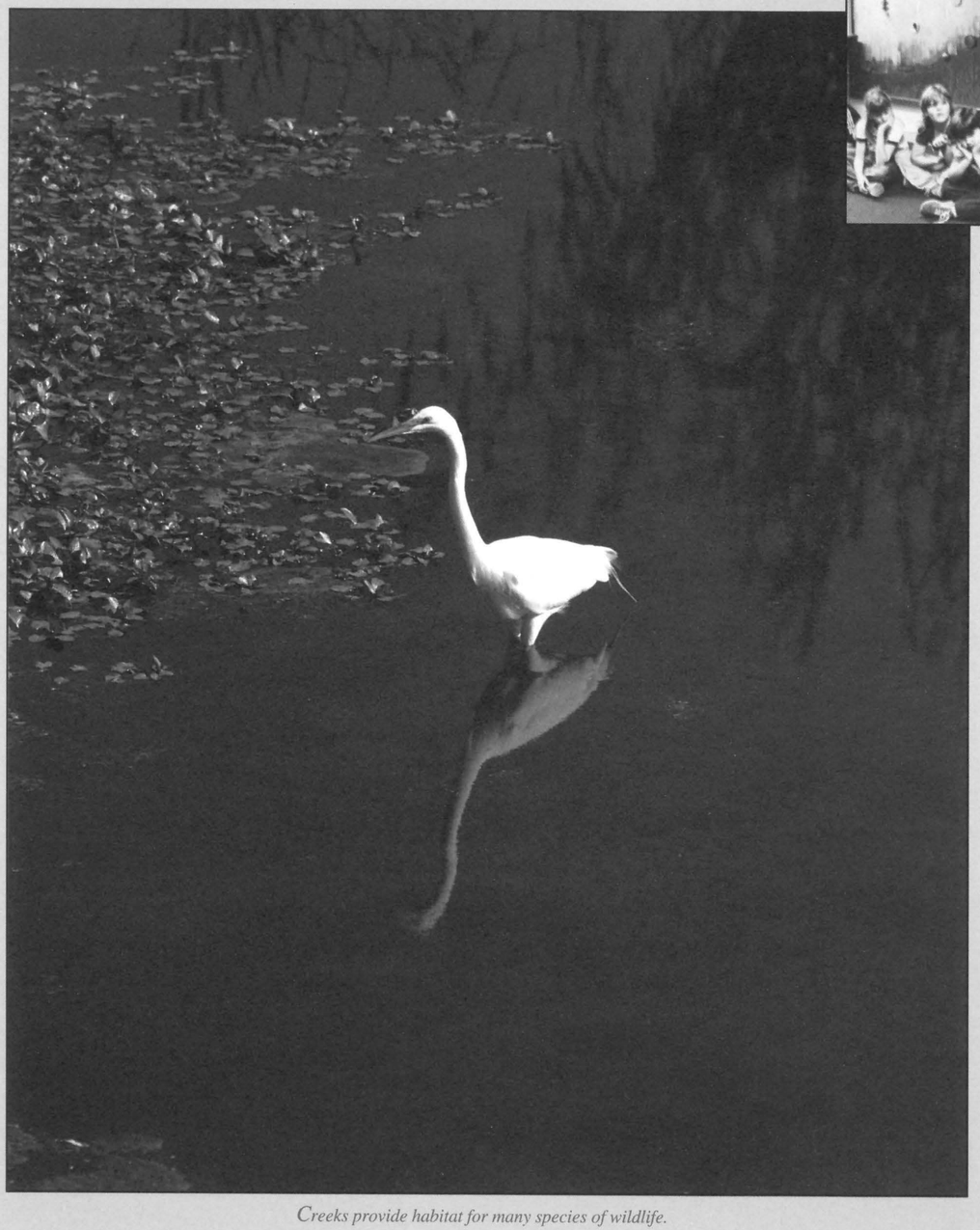
To help develop projects that meet community needs and that can be built within various technical, social, economic, and environmental constraints, the district undertakes a detailed planning process. Projects are planned by a team of district engineers environmental planners and scientists. This team develops several alternative solutions for the flood problem; organizes public meetings, neighborhood workshops, and public hearings; evaluates the alternatives; and selects the most acceptable alternative to recommend to the board of directors.

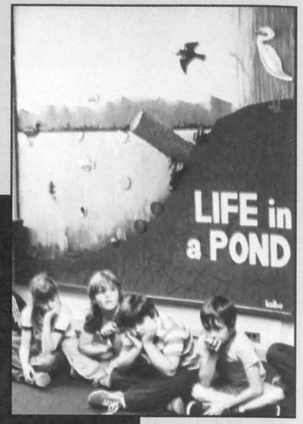
COMMUNITY INVOLVEMENT

Local citizens may comment on district projects or activities through a variety of means: mail or telephone surveys, citizen advisory committees, neighborhood workshops, public hearings, and public comments at district board meetings.

The district holds neighborhood workshops at various stages in the planning of a project. These workshops generate a significant amount of pertinent project information from the public. At public workshops district staff describe the extent of the flooding problem to affected residents. Staff presents alternative solutions and their impacts.

Through public meetings, the district learns the needs, concerns and preferences of the people affected by the project. This information is used to develop a solution that reflects a





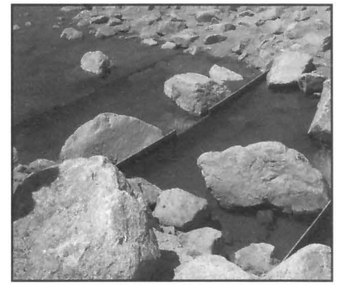
Environmental protection through education.

Creeks provide habitat for many species of wildlife.





Revegetation of a gabion-lined creek bank . . . and of a baylands levee.



Fish ladders can be installed in creeks for environmental mitigation.

community consensus. For example, on one flood control project the district presented two alternatives: a concrete-lined channel and a planted gabion-lined channel. Because of the local community's strong environmental and aesthetic concerns, district staff recommended that the board approve the gabion-lined channel, even though it was more expensive than the concrete channel.

ENVIRONMENTAL CONCERNS

State law requires that the district evaluate the environmental impacts of its projects. If there are significant environmental impacts associated with a project, the district prepares an Environmental Impact Report (EIR) that evaluates the impacts and describes how these will be mitigated. If there are few or no impacts, the district prepares a Negative Declaration in lieu of an EIR. In some cases, a federal Environmental Impact Statement (EIS) may also be required and is prepared concurrently. These documents may point out such things as the need to protect and monitor archaeologically sensitive areas, the need to modify a project to limit its impact on the habitat of an endangered species, or the need to revegetate the channel to restore a wildlife habitat.

The district then holds public meetings to collect advice and comment from the community regarding the proposed project. As a result of these meetings the report may be revised in response to the public's concerns. Finally, the district holds a public hearing at which the board considers the staff findings and public testimony and approves, modifies, or disapproves the proposed project.

REVEGETATION AND MITIGATION

The district strives to minimize the impacts of its flood control projects on the natural environment. Where it is impossible to avoid major impacts, the project includes a mitigation element to re-establish riparian habitats or otherwise mitigate a project's environmental effects. Many miles of flood control channels have been revegetated with native plants to provide riparian habitat for wildlife and to improve the appearance of newly constructed channels. Measures such as fish ladders are sometimes installed to allow passage of migrating fish.

In some cases, the district attempts to restore the riparian habitat in the same location where flood control improvements have occurred. When it is not practical to perform on-site





During construction . . . after revegetation.

mitigation measures, revegetation or other restoration occurs instead at another location with a habitat value comparable to the affected site.

PROJECT DESIGN

Once the engineer's report and environmental impact report for a project have been approved by the board of directors, and all permits and agreements have been obtained from federal and state regulatory agencies, the design division staff can proceed with preparation of construction drawings and specifications. A team of engineers prepares a detailed design of structures and other improvements in accordance with applicable codes, regulations and standards of professional practice. During this time, the design team handles several important tasks that must be completed before construction can begin, including securing necessary encroachment permits, establishing right-of-way limits, resolving traffic issues, relocating utilities, and evaluating construction materials.

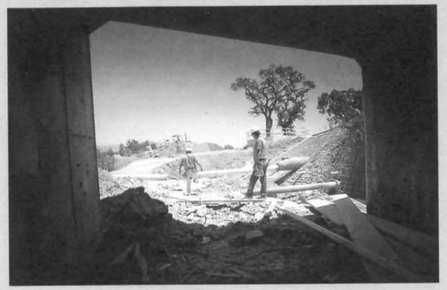
Upon completion, the construction plans and specifications are submitted to the board of directors for approval to advertise for construction contract bids. The district awards the construction contract to a responsible contractor with the lowest bid.

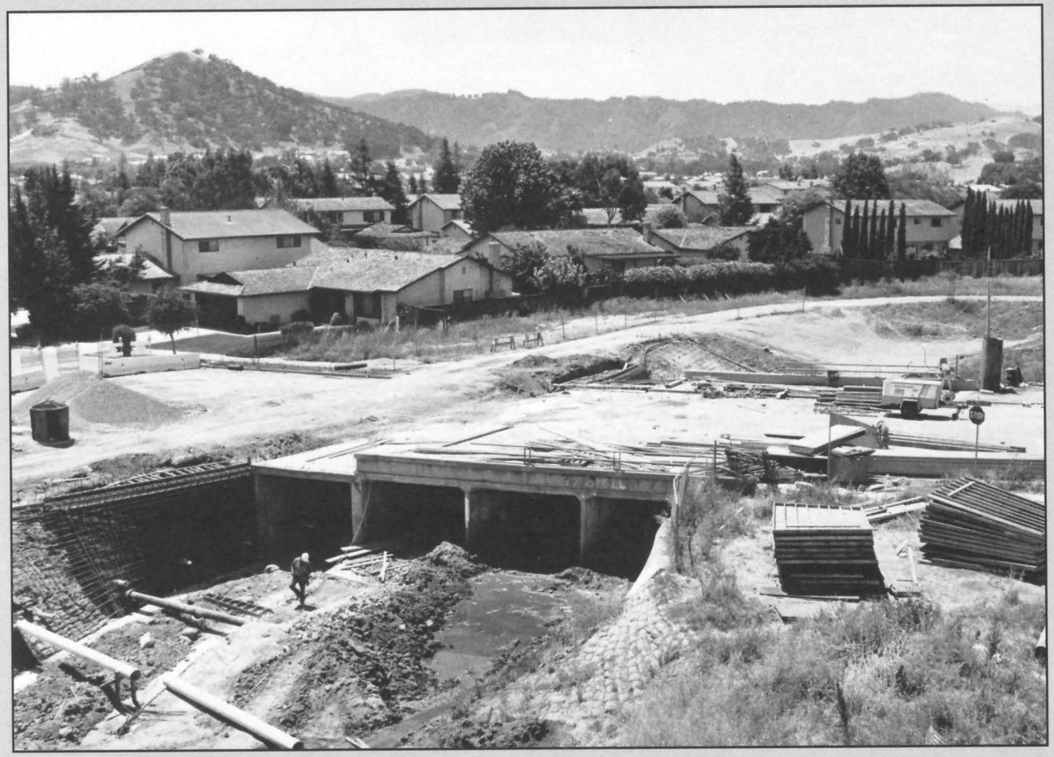
CONSTRUCTION

The district's construction division is responsible for administration of the construction contract including day-to-day inspection of the work. Following award of a contract, a notice to proceed is sent to the contractor and a preconstruction conference is held with representatives of the contractor and all agencies involved with the project. Attendees usually include representatives of the contractor, the designers, the inspectors, the city and county jurisdictions involved, and all utilities that may be affected by the work.

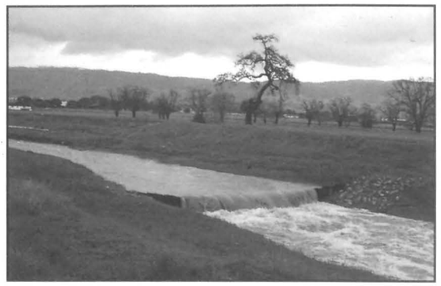
During construction, reports of progress are prepared and payments are made to the contractor. Any changes must be approved by the board of directors. When problems arise in the field that are not clearly covered by the construction plans and specifications, the construction division coordinates meetings between the designers, inspectors, and the contractor to resolve them.

When a project is completed, a final inspection is conducted and the board is asked to accept the project. The project is then turned over to the district's maintenance department.





Bridge construction over Llagas Creek in Morgan Hill.



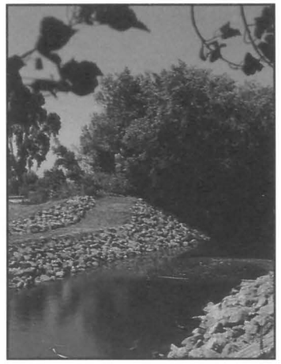
Earth-lined channel



Rectangular concrete channel



Trapezoidal concrete channel



Rock-lined channel



Gabion channel

RIGHT-OF-WAY ACQUISITION PROCEDURE

Usually the district needs to acquire property prior to construction of flood control projects. When property is required for a district project, these procedures apply:

■ The acquisition process begins when the needed property is appraised to determine its fair market value. The owner is given the opportunity to accompany the appraiser during the inspection and to bring out any salient features that the owner believes to be relevant to the value of the property.

■ Upon completion of the appraisal, a member of the district's real estate division informs the owner of the appraisal and works out the details of the purchase of the property.

■ Once an agreement is reached, the district opens an escrow and pays all fees relative to the conveyance of the property to the district.

■ If the property owner believes he or she is being unfairly compensated, or that the district's use of the property will not be for the most public good, he or she may refuse the district's offer and the district may choose to litigate the matter. As a last resort, the district may seek to use the right of eminent domain, in which the court decides whether the district may acquire the property and at what price.

■ An owner or tenant of a residence or business that is acquired by the district may be eligible for relocation payments pursuant to applicable state and federal laws. Generally, the district will pay the owner's moving expenses, the increased cost if any, of purchasing or renting a replacement residence, and the incidental closing expenses incurred in buying a replacement residence.

A VARIETY OF ALTERNATIVES

The following pages illustrate the wide variety of corrective flood control measures that the district may employ. These options can be used independently or in combinations. For example, levees or floodwalls may be used in conjunction with an earth-lined trapezoidal channel.

Rectangular concrete channel

Commonly called a U-frame channel, this option is used where the adjacent land uses have encroached very close to the creek, thus limiting the land available for channel enlargement. It is also appropriate in upstream reaches where the channel slope is very steep and the velocity of the water is high. Construction cost of this option is high, maintenance cost is low.

Trapezoidal concrete channel

This alternative is generally used under the same conditions as the rectangular concrete channel, but where slightly more land is available. The trapezoidal channel is less costly to construct because the concrete channel sides do not have to be as highly reinforced or as thick as rectangular concrete channel walls.

Rock or gabion channel

Where the speed of the water is not extreme, rock or gabions can be used to protect the creek banks. This option requires more land than smooth concrete channels, but allows some revegetation of creek banks.

Trapezoidal earth channel

This option is possible if the creek can be widened to the point where the average velocity of the water becomes non-erosive (generally less than six feet per second). The cost of maintaining these channels is usually high because in most cases, vegetation must be removed regularly.

Levees

This method involves building up channel sides to contain floodwaters. It is often used in low-lying areas, where flood control channels must be designed to carry water into the San Francisco Bay against the tides. Levees generally have mildly sloping sides and a maintenance roadway on top.

Floodwalls

This option is used in situations that would require levees, but where the land available cannot accommodate the width of a levee. Floodwalls take less land but are generally more costly to construct than levees.

Modified floodplain

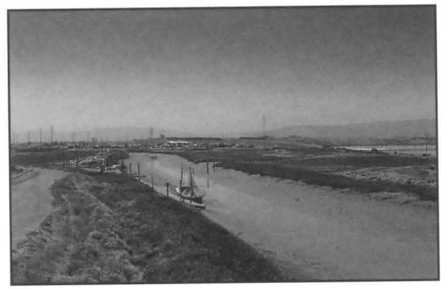
This alternative, which preserves the natural creek environment, utilizes setback levees —low levees constructed away from the creek and used to contain floodwaters. This option requires a wide area and has much less of an environmental impact than most of the other alternatives.

Bypass channel

This method uses a secondary channel constructed adjacent and parallel to the existing creek alignment. This is a very effective alternative where there is land available on either side of a creek. Construction of a bypass channel provides the needed flood capacity without significantly impacting the natural creek habitat. The bypass can be composed of any one or a combination of different channel types.



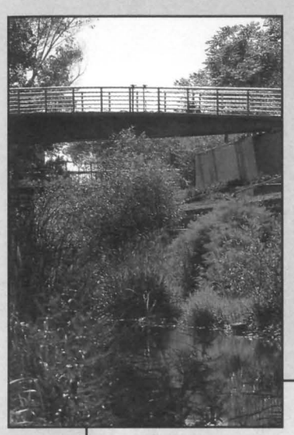
Floodwall



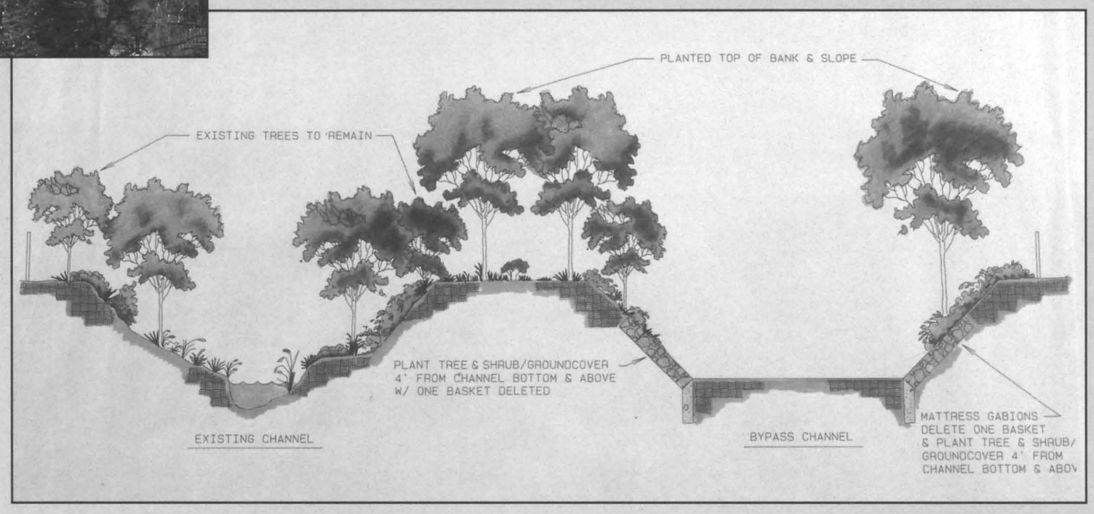
Levee

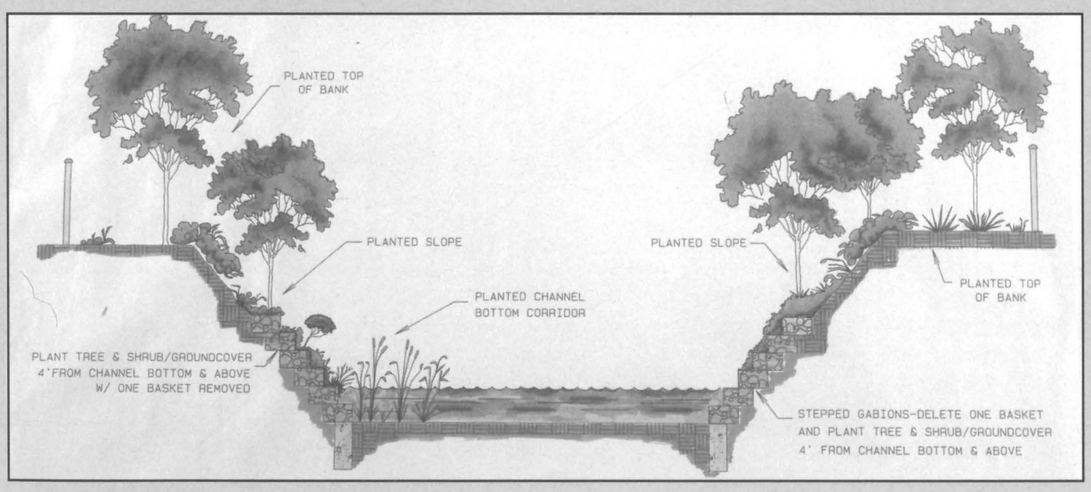


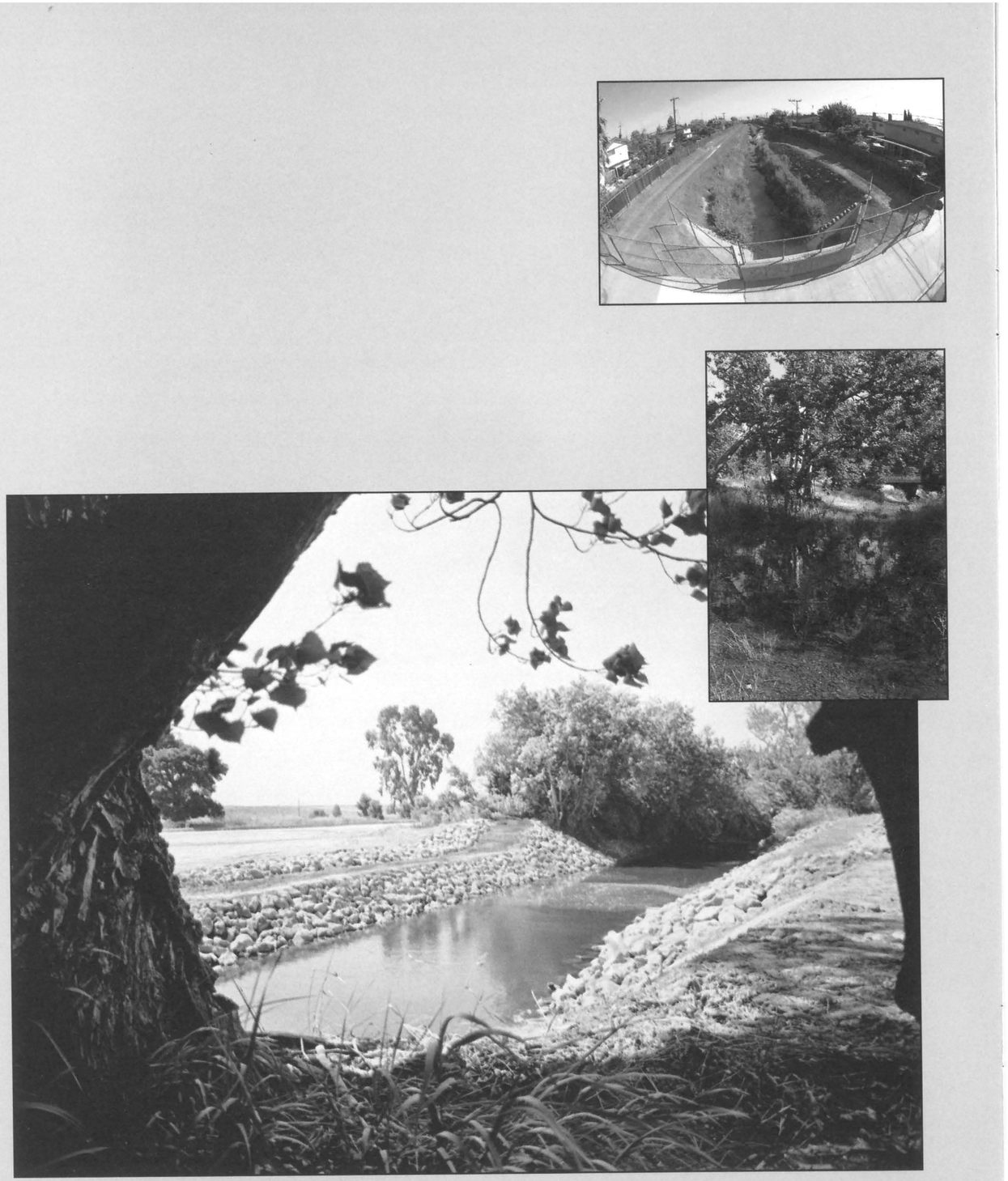
Modified floodplain



Bypass channel







The project pictured above, shows flood protection provided by a modified floodplain, allowing up to 80 percent of the natural vegetation to remain.

RESPONDING TO CHANGING PUBLIC VALUES

Since the creation of the Santa Clara County Flood Control and Water Conservation District in 1951, when the area was largely agricultural, the district's approach to flood control has changed dramatically. In response to changing community values, the district has modified both the types of projects it builds and the level of flood risk for which these projects are designed.

During the 1950s and 1960s, most flood control facilities were designed for efficiency — concrete-lined channels that would move water to the bay as quickly as possible and require minimum right-of-way. Little regard was given to the environmental impacts, recreational potential, or aesthetics of a project. These facilities were built for the 2-percent flood — the flow that, over a long period of time, would occur on the average of once in 50 years.

The environmental movement of the 1970s ushered in a new sensitivity, arousing public concern for the impacts of development on the living environment. New environmental regulations, including the need to prepare environmental assessments and documents, required the district to integrate the preservation of natural qualities and scenic beauty into flood control designs. Building flood control facilities with minimal impacts on the surrounding environment became a community priority, and where possible, concrete-lined channels gave way to gabions, bypass channels, earth levees, and other, less intrusive flood control methods.

The 1970s marked the start of the federal flood insurance program and new floodplain disclosure standards for the real estate industry. These developments helped to raise public awareness of the damage potential from flooding, creating a demand for a lower level of risk. During this decade the district began providing protection against the 1-percent flood.

During the 1970s and 1980s, as development in the valley continued to increase and the pace of life quickened, the public began to view creeks and streams as precious natural resources and places of respite in urban areas. When compatible with flood protection operations, the district designs flood control facilities to accommodate walking and riding trails, parks, open space and pathways. Many of the popular public trails and parkways that exist along flood control channels today were begun in this period.

In the 1990s, the district remains committed to flood control facilities that incorporate recreational uses and make creeks more accessible to surrounding communities. Environmental protection remains a priority as well: The district has moved into the forefront of the re-establishment and maintenance of streamside habitats. Coyote Creek is an example of a project that addresses both environmental and recreational concerns. Flood control improvements on the creek incorporate measures to mitigate impacts to the endangered salt marsh harvest mouse and feature public access to the project in conjunction with the San Jose Parks and Recreation Department.

FLOOD CONTROL FUNDING

FUNDING SOURCES

The district relies on several different funding sources to finance flood control work in each zone. The district's primary sources of revenue are its allocation of the 1 percent property tax and voter-approved benefit assessments. In some cases, however, a project may be paid for with a combination of funds, including ad valorem tax revenues, benefit assessment revenues, federal and state funds, long-term debt, redevelopment agency funds, and private developer funds.

AD VALOREM PROPERTY TAX

A primary source of flood control funding is the district's allocation of the 1-percent property tax, which is levied upon privately-owned land and improvements. Since Article XIIIA (Proposition 13) was added to the California Constitution in 1978, the district has received an allocation of the county's 1-percent tax levy in each flood control zone. Each zone's allocation is made by the county tax collector and is based on the projection of the average tax revenues collected for flood control in each zone during the three years prior to Proposition 13.

BENEFIT ASSESSMENT REVENUE

Another major source of funding in the flood control zones is benefit assessment revenue. Benefit assessments first were levied in 1981 following the loss of more than 55 percent of the district's flood control funding with the passage of Proposition 13, and were approved by the voters in 1982 to continue for nine more years. In November 1986, voters in four of the zones approved ballot measures that further increased benefit assessment rate limits. An increase was not proposed for the North Central Zone until 1990, when it was approved. By increasing annual benefit assessment revenues in all zones, the district can finish critically needed projects by as many as 20 years sooner than the original assessment rates would have allowed.

The benefit assessment program also permits increased levels of maintenance on most creeks, and enables the district to meet cost-sharing requirements on federal flood control projects in the Central, East and South flood control zones. The revised benefit assessment programs also provide the district with more flexibility in financing flood control projects by enabling it to use long-term debt financing, such as certificates of participation (COP's).

BENEFITS ASSESSMENTS VS. TRADITIONAL ASSESSMENTS

Benefit assessments differ from other traditional types of assessments that are levied by cities and used for construction of such public facilities as streets, sewers, or water systems.

Traditional assessments are levied on properties following a majority-protest hearing and usually are used to retire bonded indebtedness incurred to build the facility. In contrast, flood control benefit assessments are approved by voters, and they are levied annually by the board of directors following a public hearing on proposed assessment rates. Benefit assessment proceeds can be used for all flood control-related costs including construction and maintenance.

Property owners in Santa Clara County pay one of five different rates, based on the relative amount of storm water runoff expected from each parcel (see box). The amount of runoff from a parcel relates directly to its size and its use. Generally, because developed properties are more impervious to rainfall infiltration, they generate more runoff and hence are subject to higher assessment rates.

FEDERAL AND STATE FUNDING

In some cases, the United States government will fund a portion of a flood control project in conjunction with a local sponsor or sponsors. The federal government will undertake the project only after a federal study indicates the project's benefits are greater than the costs, and when Congress appropriates construction funds. When a project is authorized by Congress for study or construction, funds are appropriated to cover the study costs and the construction costs of the flood control facilities.

Federal funds are not "free" to the district. They take much time and effort to secure. In addition to technical review and coordination, the federal process itself is very involved and requires a major commitment on the part of the district. In addition the district, as the local sponsor of federal projects, is responsible for constructing bridges, relocating utilities, and purchasing rights-of-way. Most of these local costs are subject to later reimbursement by the California Department of Water Resources. State reimbursements are 70 percent of the non-federal costs. The remaining 30 percent and all future maintenance costs are borne by the local sponsor. The district either has been, or is, the local sponsor of several such projects, including those on Uvas, Llagas, Coyote, Upper Penitencia, Berryessa, and Lower Silver creeks, and the Guadalupe River.

REDEVELOPMENT FUNDS

When a flood problem exists within a designated redevelopment area in a city or the county, and that problem is identified as one of the conditions contributing to "blight" as defined under redevelopment law, tax funds raised within the redevelopment area can be used for flood control purposes. A redevelopment agency also may contribute funds to develop recreational uses along a flood control project. For example, the San Jose Redevelopment Agency contributed funds to build a three-mile long community park along the Guadalupe River through downtown San Jose in conjunction with a major federal flood control project.

PRIVATE DEVELOPMENT CAPITAL

Another, less common, method of funding flood control projects is the use of private development capital. In some instances, at the request of the district, developers may be required by the city or the county, as a condition of development, to build flood control facilities to protect their property. Under this procedure, the developer pays for construction of all facilities necessary to protect the development. If a district flood control project has been approved for construction by the district's board of directors, the developer may be asked to build temporary facilities to provide flood protection until the district's permanent facilities can be built.

An example of cooperation between private developers and the district occurred in the early 1990's in Gilroy when three developers advanced the district funds to build bridges and box culverts at major street crossings. This work provided flood protection to hundreds of existing and planned homes. The advance of private funds benefited both the district and the developers; the district was able to proceed with construction of planned facilities four years sooner than expected, and the developers were relieved of having to build costly retention ponds and interim drainage facilities as temporary measures until permanent measures could be installed.

UVAS CREEK: AN EXAMPLE OF MULTI-SOURCE FUNDING

In some cases, the district works with several other agencies to fund flood control projects. The Uvas Creek project is one example. The district worked with the U.S. Army Corps of Engineers and the city of Gilroy to ensure that the flood control and pathway plans were integrated and compatible.

BENEFIT ASSESSMENT RATE CATEGORIES

A. Commercial and industrial land uses

B. Apartments and other high density residential uses, schools and churches

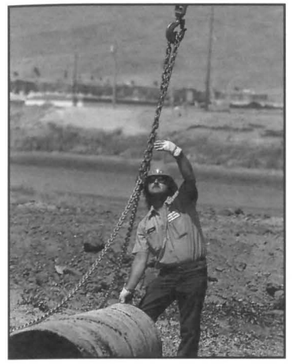
C. Single family residential and small multiple units

D. Land used for farming, vine yards, irrigated crops, parks, etc.

E. Vacant land — undisturbed, not tilled, planted or irrigated; benefitted grazing land, salt ponds
   1) urban vacant land
   2) rural vacant land
   3) small parcels used exclusively for wells



FLOOD CONTROL MAINTENANCE





A YEAR-ROUND JOB

It's not enough to build levees, floodwalls and culverts, and revegetate creek slopes. These facilities must also be maintained to ensure they continue to do the job for which they were designed.

The district's maintenance staff inspects, cleans and repairs flood control facilities. Maintenance activities may vary from watershed to watershed, or from one part of a creek to another, depending on a variety of conditions. For example, reaches of some creeks tend to accumulate silt deposits. When these deposits reduce the channel's flood-carrying capacity to an unacceptable level, the district responds by removing them — usually to a landfill site. Other reaches have highly erosive soils, and may require reinforcement with concrete-filled sacks, rock boulders or gabions.

PLANT GROWTH AND DEBRIS REMOVAL

Plant growth can also pose a maintenance problem. When large amounts of vegetation reduce the channel's capacity to carry flood flows, all or some of the growth may have to be removed, depending upon the environmental effects, the difficulty of the operation, and the effect the growth has on the flood-carrying capacity. Sometimes flood control facilities can become overgrown with weeds and brush and pose a fire hazard. Maintenance personnel continually work to remove overgrowth and keep it from growing back.

District maintenance personnel perform many other jobs relating to district flood control facilities, such as reinforcing levees, cleaning structures, repairing fences, posting regulatory signs, constructing gates or barriers to eliminate trespassing problems, removing fallen trees, maintaining access roads, and cleaning up trash and garbage that has been improperly dumped in the creeks. Maintenance crews are also responsible for monitoring and preserving revegetation projects once they are established.

MAINTENANCE OF PRIVATE VS. PUBLIC LANDS

Except in emergencies, the district carries out maintenance work only on those sections of creeks for which it has rights-of-way. This practice is based on the long-standing district policy that the district cannot spend public funds to improve private lands. In some instances the district will acquire maintenance easements from property owners to maintain a particular segment of a creek. Unless such an arrangement is made, the private property owner is responsible for performing the maintenance on his or her own property.

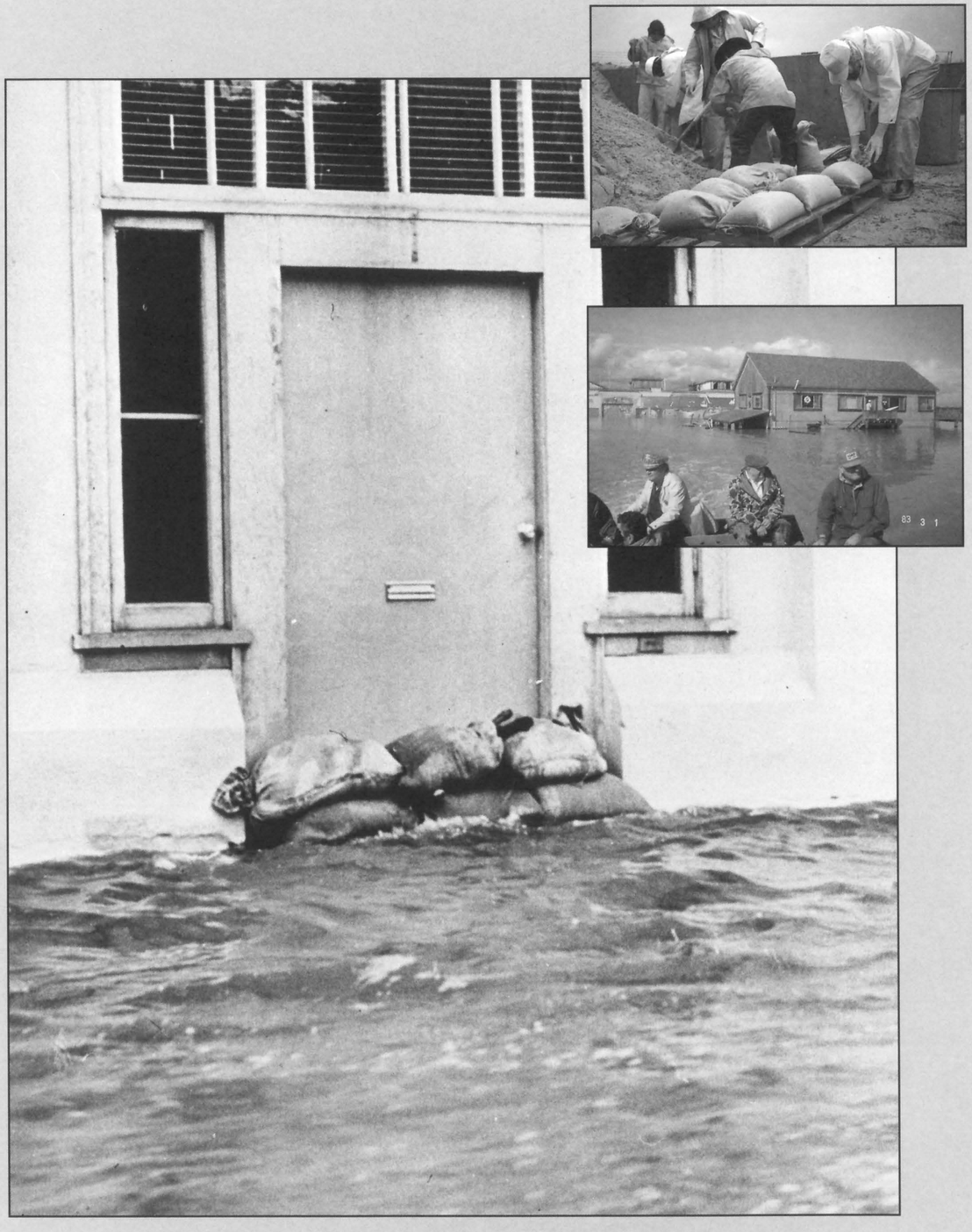












MONITORING FOR EMERGENCIES

The district maintains a flood emergency "alert" during the rainy months of October through March. During this time the district closely monitors streamflow and reservoir conditions. To obtain an accurate picture of weather conditions the district gets daily weather reports from its meteorologist and from the National Weather Service.

When a major storm threatens to cause significant flooding, the district staffs its emergency operations center with key personnel. Reservoirs and creeks are continuously monitored to project potential flow rates and depths and to coordinate the district's maintenance activities. If an emergency threatens, the center promptly relays such information to the appropriate city and the county, and to the news media through the district's public information office.

When monitoring of rainfall, streamflow, and weather indicates a high possibility of flooding in populated areas, the district notifies the staff of the fire or police department of the affected city or cities. The district does not issue flood warnings to property owners, but relies on the emergency personnel of the community to make decisions about evacuations. Emergency operations personnel meet each October with key city and county officials to review emergency notification procedures.

DURING A FLOOD

The district's maintenance personnel investigate flooding incidents and dispatch field crews to those areas where something can be done to reduce flooding. However, the district does not have the resources to fight all the major and minor floods that may occur during a major storm.

Generally, district field crews clean trash and debris from trash racks and culvert entrances, remove fallen trees from creeks and channels, and place sandbags in areas where the creek banks are about to be overtopped by flood waters. During major storms, the district has, in some instances, mobilized both district and contract personnel and equipment to repair damage to major flood control facilities, such as levees that have been breached.

Locally, city public works department crews try to reduce flood hazards by clearing out storm drains and gutters. Police, fire fighters, and city officials work to notify residents of potential flooding. Residents can obtain sandbags to fight flooding from local city or county distribution centers or from the district's corporation yard located at 5750 Almaden Expressway in San Jose. The district provides sandbags to individuals and to other public agencies without cost. Phone your local city or the district for information on availability of sandbags.





WHAT TO DO BEFORE AND DURING A FLOOD

You can take several steps today to reduce or eliminate the risk of damage should flooding occur:

• Look at a flood map (available through your city, the county or the district) to learn where flooding may occur in your neighborhood.

• Learn the safest route from your home or place of business to high ground.

• Keep a portable radio, extra water, emergency cooking equipment, and flashlights in working order.

• Patch your foundation and seal all vents, doorways, windows, and garage doors. Contact the district for a list of these and other techniques for keeping floodwaters out of your home.

• When a flood does occur, the safety of your family is the most important consideration. Since floodwaters can rise very rapidly, you should be prepared to evacuate before the water level reaches your property.

• Keep a battery-powered radio tuned to a local station and follow emergency instructions.

• When outside the house, remember that floods are deceptive. Don't attempt to walk through floodwaters that are more than knee deep.

• Use sandbags primarily to divert water away from your property or doorways. Do not rely on sandbags to keep water outside the building.

If time permits:

• Turn off electricity at the service box. Close the main gas valve only if you smell gas, hear a hissing sound, or are told to do so by fire or other emergency personnel. Do not touch electrical equipment unless it is in a dry area and you are standing on a dry surface while wearing rubber gloves and rubber-soled boots or shoes.

• Move valuable papers, jewelry, clothing, and other possessions to upper floors.

• Fill bathtubs, sinks, and jugs with clean water in case regular supplies are contaminated.

• Board up windows or protect them with storm shutters or tape to prevent flying glass.

• Bring outdoor possessions inside, or tie them down securely.

• If it is safe to evacuate by car, stock it with nonperishable foods and a plastic container of water, keep the gas tank at least half full, and do not drive where water is over the roads.







WHEN THE WATERS SUBSIDE

After a flood, the Federal Emergency Management Agency (FEMA) may provide disaster relief funds to a community for the repair of utilities and other community facilities to meet emergency needs. Federal assistance to individuals may be available on a case-by-case basis through FEMA field offices. These offices are set up in flood-stricken communities soon after a flood has occurred.

FLOOD INSURANCE

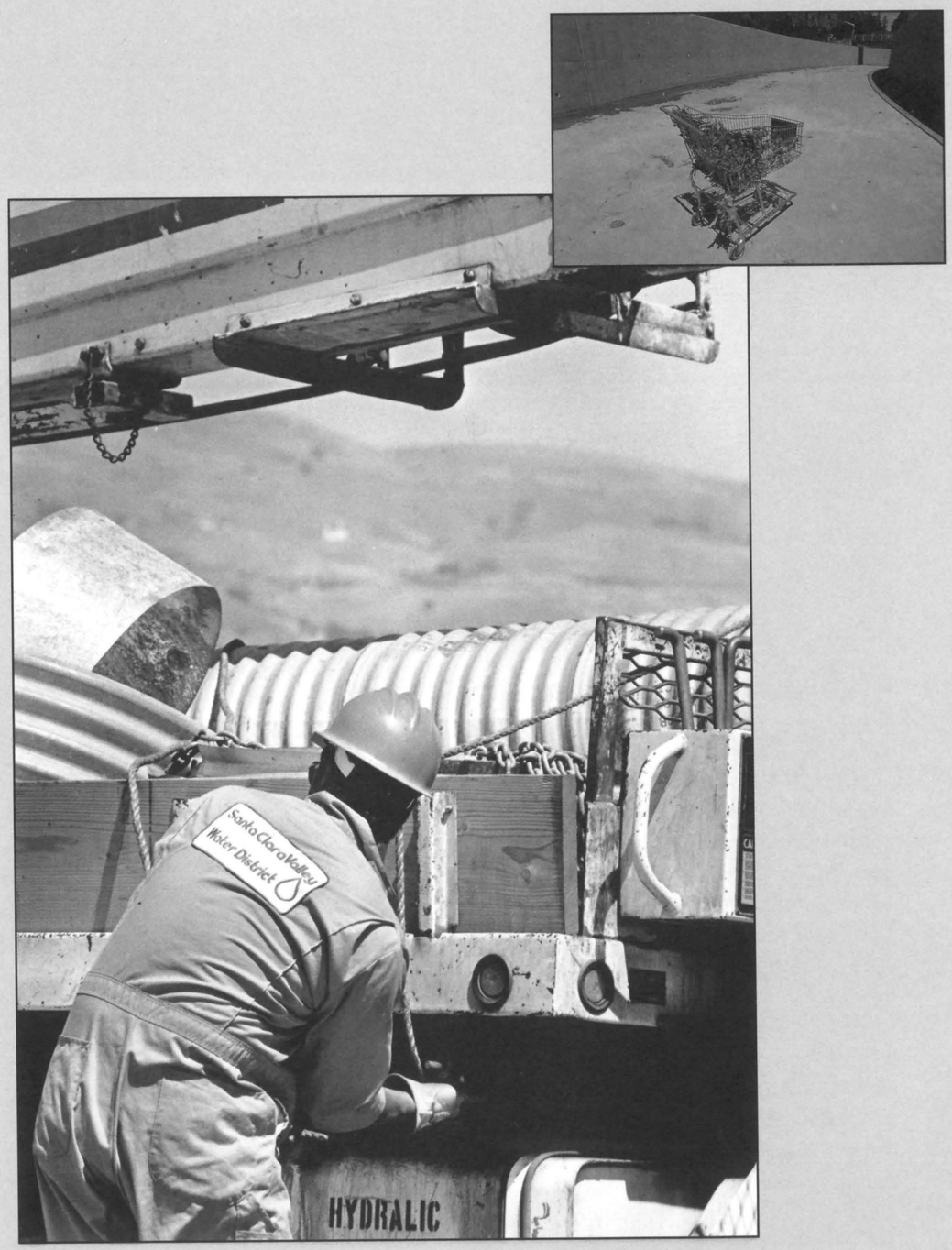
Most homeowner insurance policies will not protect against losses from flooding. Property owners and renters, however, can safeguard their homes and belongings with supplemental flood insurance.

The National Flood Insurance Program (NFIP) enables property owners to acquire flood insurance at affordable rates. The only requirement is that the property being insured be located in a community that participates in the NFIP. All cities in Santa Clara County, and the county, participate. Flood hazard areas are outlined on maps, but a parcel does not have to be in a flood zone to be insured.

Coverage on structures and their contents is available for residential, business and agricultural properties, and for properties owned by private nonprofit organizations and local and state governments. For property located in identified flood hazard areas, the purchase of flood insurance is mandatory to obtain a loan from federally-insured lending institutions.

HINTS ABOUT ACQUIRING FLOOD INSURANCE

Any property/casualty insurance agent or broker can sell a flood insurance policy. Generally, there is a five-day waiting period for this policy to become effective, so it is unwise for someone in a flood-prone area to wait until the flood water is rising to apply. Once a policy is purchased, it should be kept in a safe place, such as a safety-deposit box. Know the name and location of the agent who issued your policy. It's a good idea to make an itemized list of personal property, including furnishings, clothing, and valuables. Photographs of your home, inside and out, may help in settling insurance claims.



WATER QUALITY





AN ISSUE OF CONCERN

As concern about water quality issues heightens at the local, state, and national levels, public agencies are becoming more vigilant in their efforts to protect water supplies from contamination and to correct existing problems. In addition to many other efforts to preserve and enhance water quality in Santa Clara County, in recent years the district has begun to examine the links between water quality and flood control operations.

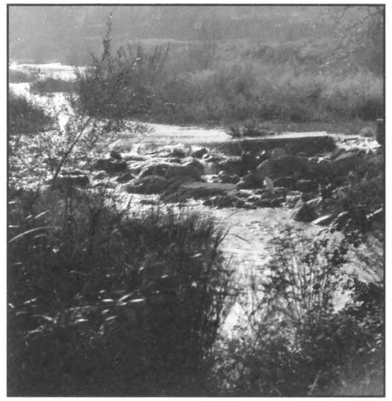
Flood control channels and creeks may act as conduits for many kinds of contamination such as: surface runoff containing oil and grease, leaky underground tanks, and hazardous materials improperly disposed of on or near creek beds. The district is concerned about preventing contaminants from entering flood control channels, ensuring that flood control projects are not built over contaminated sites, and preventing flood control channels from spreading existing contamination into the San Francisco Bay.

In the years ahead, water quality issues may have a significant effect on the costs and types of flood control projects, and the methods used for their operation and maintenance.

Despite long-standing efforts by the district and other agencies to encourage county residents to protect local water quality, public disposal of hazardous materials in and near flood control channels continues. In 1989 the district formed a new organizational unit to handle the investigation and removal of toxic substances encountered on district property. This section also investigates the presence of toxics on district construction sites, helps plan construction projects to avoid existing groundwater contamination problems, and coordinates the removal and disposal of contaminated soils. It provides emergency response to toxic spills and leaks that flow into creeks, reservoirs or other district facilities, and recovers the costs of cleanup from the responsible party or parties.

NONPOINT SOURCE POLLUTANTS

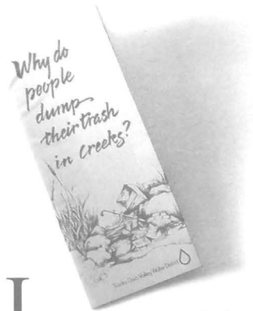
In addition, the district is spearheading important efforts to alleviate nonpoint source pollutants. These pollutants collect in urban runoff that drains from vegetation, exposed soil, roofs, streets, parking lots, and industrial sites. Nonpoint source pollutants — which include heavy metals, oils and grease, pesticides, and herbicides — contaminate groundwater and are carried through flood control channels into portions of the South





Bay. The district has been working with 13 cities and the county, all of which contribute runoff to the South Bay, in the study of these pollutants and in the development and implementation of control measures to reduce this type of pollution in the county.

WHEN CREEKS ARE USED AS DUMPS

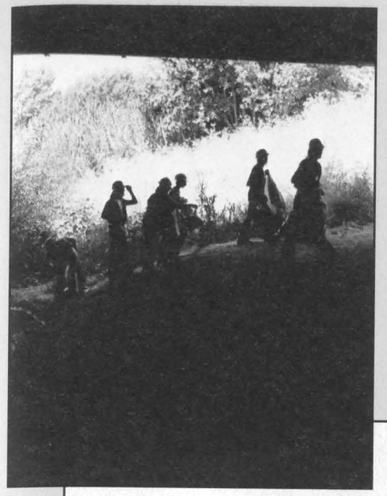


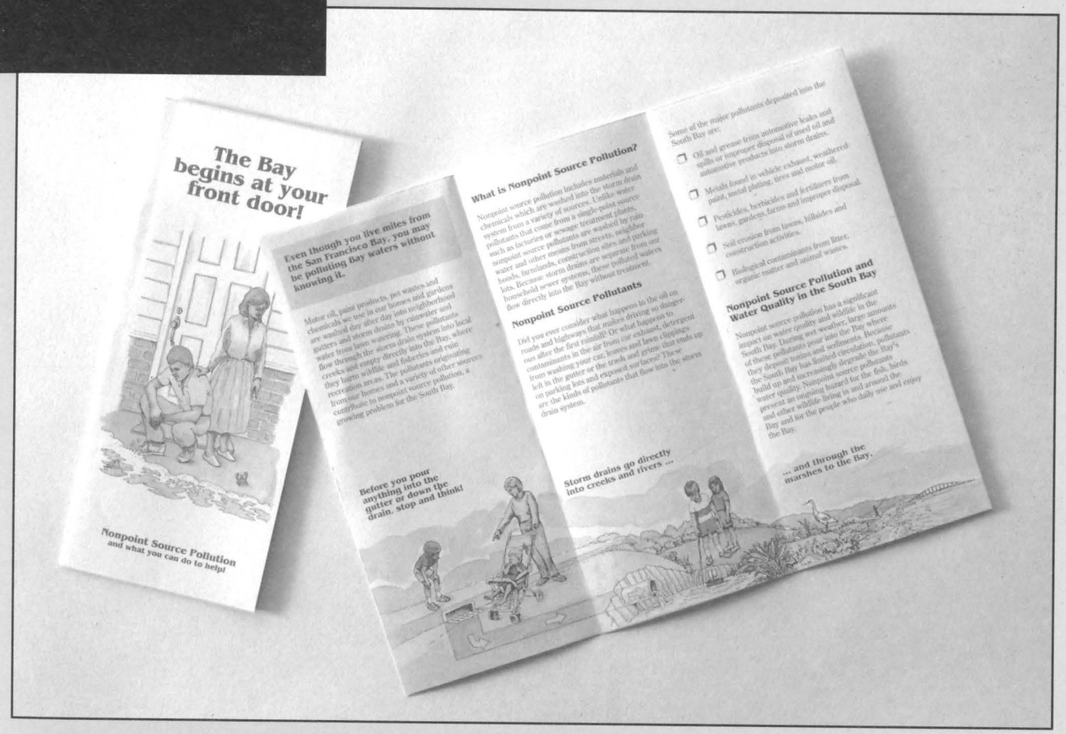
In recent years, trash dumped in creeks has become a significant maintenance problem. It is unsightly and detrimental to water quality, and can accumulate to become a flood hazard.

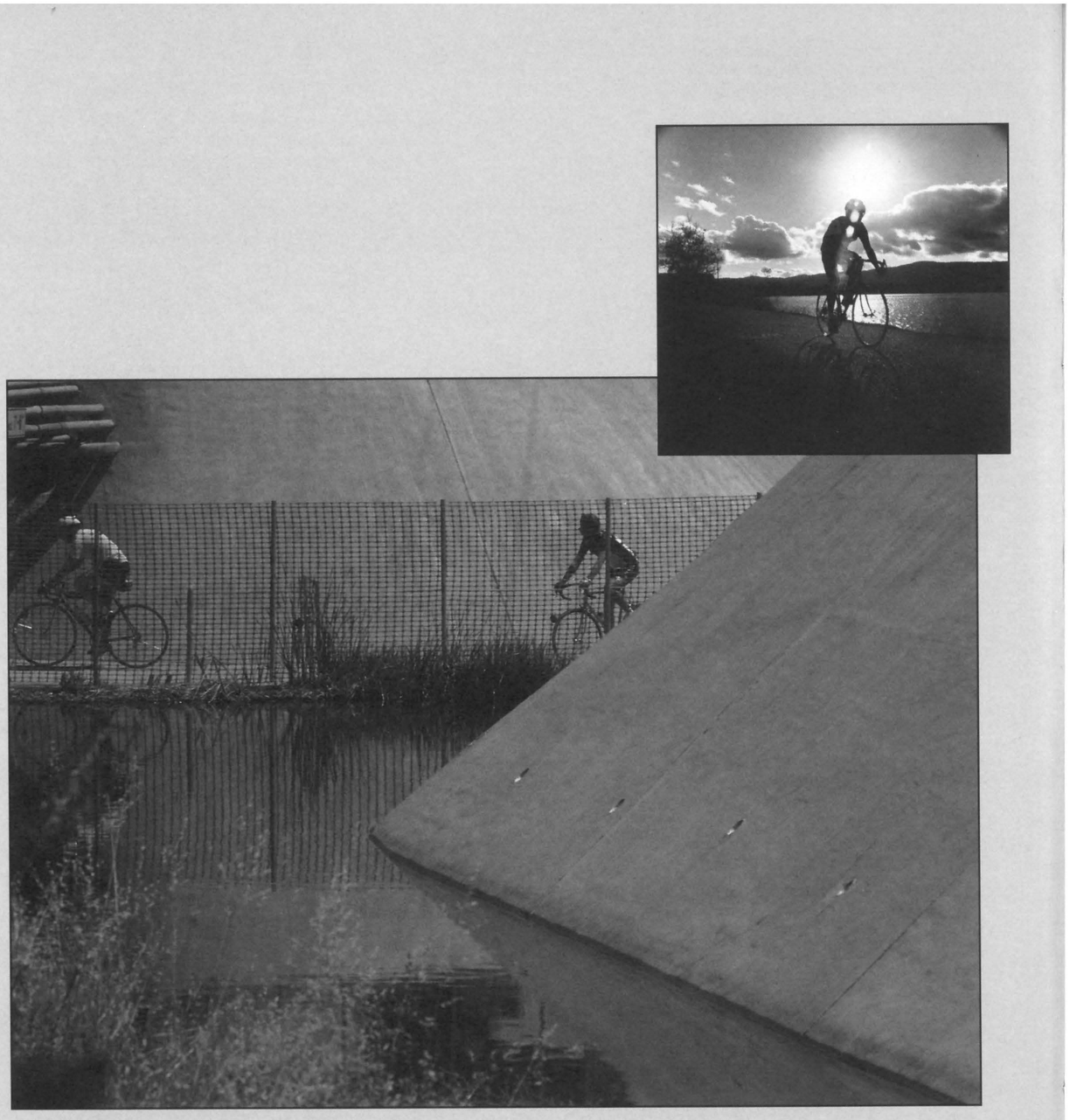
Tree branches, shopping carts, mattresses, and other large objects tend to collect with other debris in a creek to form obstructions to flood flows. This debris causes severe problems where creeks are constricted by culverts and bridges, forming barriers to storm waters that then flood out over creek banks and bridge crossings. Removal of garbage from creeks costs the district hundreds of thousands of dollars each year.

Anyone reported dumping trash or other debris into creeks is contacted by the district and asked to correct the problem. Offenders who refuse to cooperate with the district's request may be subject to prosecution, with a maximum punishment of 30 days in jail and a $500 fine. If the district believes that materials dumped in a creek pose a hazard requiring immediate clean-up, the district's directors may authorize the maintenance division to clean the site and bill the responsible party.

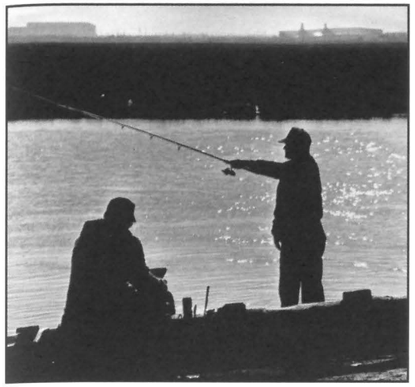
For more information, contact the district for a copy of its brochure, "Why Do People Dump Their Trash In Creeks?"







RECREATION





JOINT USES

Nearly 700 miles of creek channels wind their way through the county, some providing ideal sites for urban trails and parks. Joggers, walkers, bicyclists, picnickers, bird watchers, and even rollerskaters enjoy these scenic and recreational resources thanks in many cases, to joint use agreements between the district and the cities and county.

Where the district is the underlying land owner and where it is possible for the public to enjoy activities in or near a reservoir, or along a creek, without interfering with that facility's primary purpose, the district typically executes a joint use agreement with another public agency. In exchange for public access to district lands, the other agency agrees to regulate these activities, build related structures, assume responsibility for any damages that may result from public use, and assume liability for activities related to the public use.

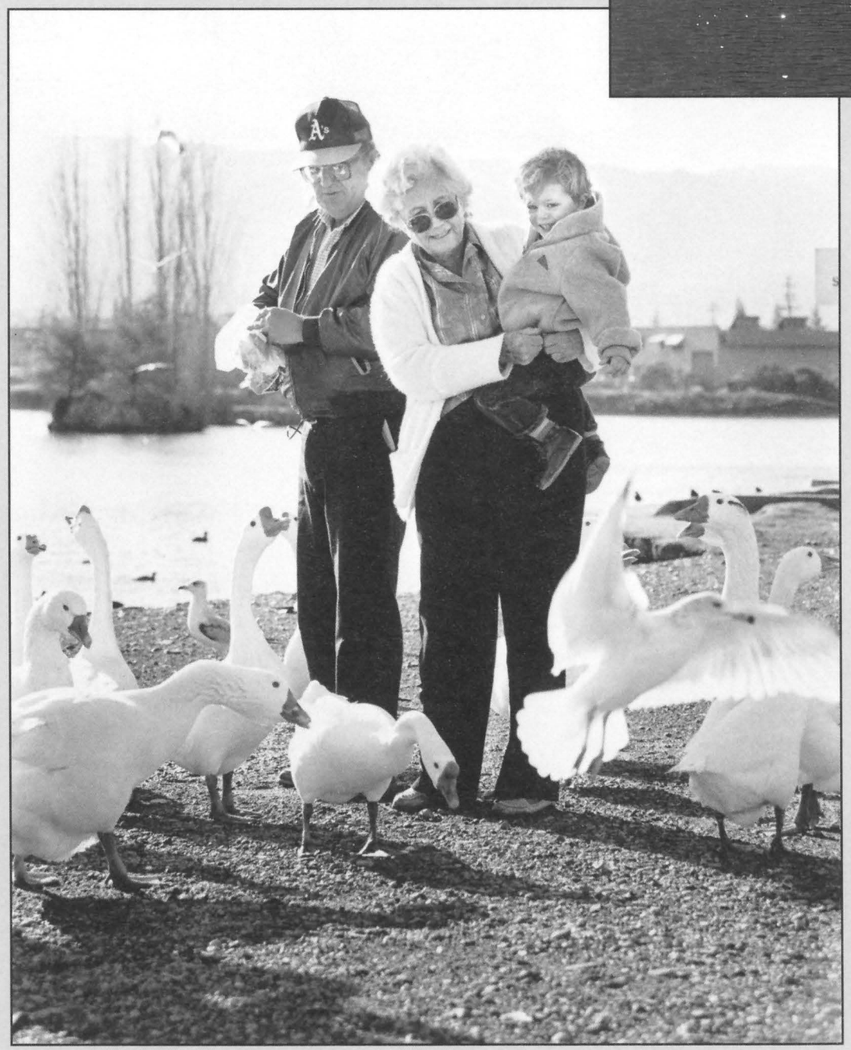
The district traditionally has encouraged joint use agreements. When possible, the district designs projects to be compatible with recreation such as parks, open space, walking and riding trails and pathways. When a recreation agency is not ready to build its projects, the district often designs its flood control projects so that future recreational facilities are not precluded.

The district's water conservation reservoirs, which provide only incidental flood protection, are covered by joint use agreements between the district and the county. Percolation ponds and creeks are also available for public use through joint use agreements.

AN EXAMPLE: LOS GATOS CREEK

A good example of the application of joint use agreements for recreational use is Los Gatos Creek. The district has joint use agreements with the cities of Los Gatos, Campbell, and San Jose, and with Santa Clara County, for streamside park and trail use on this creek. Over six miles of trails have already been constructed and are heavily used by local residents. When all of the planned trails and pathways on Los Gatos Creek are completed, they will extend approximately 14 miles from Lexington Dam in the foothills downstream to the Guadalupe River in downtown San Jose. The county's master plan includes several other trails and pathways along district rights-of-way, many of which will require joint use agreements.





CONCLUSION



The district's flood control program is part of a comprehensive approach to water management for all of Santa Clara County. As such, flood control facilities are built to satisfy a variety of community needs in addition to flood control — needs for environmental protection, accessible recreational areas, and aesthetically pleasing facilities.

As the communities' needs and priorities shift, district programs respond accordingly. For example, recent attention to environmental and water quality issues in the county has had — and will continue to have —a significant effect on the design, construction, and operation of flood control facilities. It is this flexibility and responsiveness that has earned the district solid public support for its flood control programs for the last four decades.

Voter approval of increased flood control benefit assessments has allowed the district to expand its maintenance program and to speed up flood control construction countywide. With a clear indication that the public wants better flood protection, the district is moving ahead, working to design and build projects that help sustain the quality of life of present and future generations.

GLOSSARY OF TERMS

Box Culvert — A vertical-walled covered channel.

Capacity — The maximum amount of water that can flow through a channel, stream, or culvert before flooding of surrounding properties would result.

Dedication — A legal act in which one person gives another person or entity ownership of property without monetary or other compensation in return.

Drainage basin — The geographical area within which all surface water flows into a single river, watercourse, or stream; also called a watershed.

Easement — A right held by a person or entity to make use of the land of another for a limited purpose. For example, the district may secure an easement from a property owner to allow access to creeks for flood control maintenance purposes only. The property owner still retains ownership of the property.

Eminent domain — A legal principal that allows public agencies to acquire private property for the public good with payment of compensation to the property owner.

Erosion — The wearing down of a stream bank or land surface by flowing water.

Flood — A general and temporary condition of partial or complete inundation of normally dry land areas from inland or tidal waters.

Flood control — Activities that are directed toward reducing flood damages.

Flood control zones — Much of Santa Clara County is divided into five flood control zones, each based on one or more watersheds. Each zone has a separate flood control program and separate revenues and expenditures. They are the Northwest, North Central, Central, East and South Flood Control Zones (see map on page 14).

Flood damage — Damage resulting to public and private real and personal property from flood flow inundation.

Floodplain — Areas that are subject to flooding.

Flow rate — The amount of water moving in a watercourse or channel. Flow usually is expressed in cubic feet per second (cfs).

Frequency — The number of occurrences of an event — such as flooding — in a given period of time.

Gabions — Rock-filled wire baskets used to stabilize banks of channels.

Hydrology — The science of the behavior of water. Flood control hydrology is concerned with the history and projection of rainfall and the flow of water to the bay or ocean.

Impervious — The quality of being unable to pass or absorb water.

Levee — An earthen berm that is designed to contain flood waters.

Nonpoint source pollutants — Pollutants that are carried by storm water runoff into receiving waters; contrasted with "point" source pollutants such as effluent from wastewater treatment facilities.

1-percent flow — The flow that has a 1-percent chance of occurring in any given year; also referred to as the 100-year flow.

100-year flow — The flow that has a chance of occurring, on the average, once each hundred years; also referred to as the 1-percent flow.

Ordinance — A set of regulations adopted by the district's board of directors to guide district policies. It applies within district boundaries.

Peak flow — The maximum instantaneous rate of flow of water during a given storm or a given time period.

Reach — A portion of a creek or watercourse usually defined by both an upstream and a downstream limit.

Riparian — Pertaining to the banks of a river or other body of water.

Saturated — Soaked through with moisture; unable to absorb more water.

Sedimentation — Mineral or organic material that is deposited by moving water and settles at the bottom of a waterway.

Silt — Fine sand that is carried by moving water and deposited as sediment.

Subsidence — The often irreversible sinking of the land surface that occurs when underground water is depleted and clay aquifers are compressed. Subsidence has occurred primarily in the north Santa Clara Valley, and has been most serious in Alviso and downtown San Jose.

Watercourse — An elongated channel, culvert or depression, whether natural or man-made, in which water flows or may flow. A watercourse ranges in size from a small drainage depression to a major river.

Watershed — Area from which water drains. Also referred to as a drainage basin.



Flooded roads send commuters on roundabout routes to work

Creek flowed into high-tech industrial park

Officials said the flooding would not endanger future development in the fast-growing area

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